Rhodora

JOURNAL OF THE

NEW ENGLAND BOTANICAL CLUB

Conducted and published for the Club, by

MERRITT LYNDON FERNALD, Editor-in-Chief

JAMES FRANKLIN COLLINS
CHARLES ALFRED WEATHERBY
LUDLOW GRISCOM
CARROLL WILLIAM DODGE
} Associate Editors

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The New England Botanical Club, Inc.

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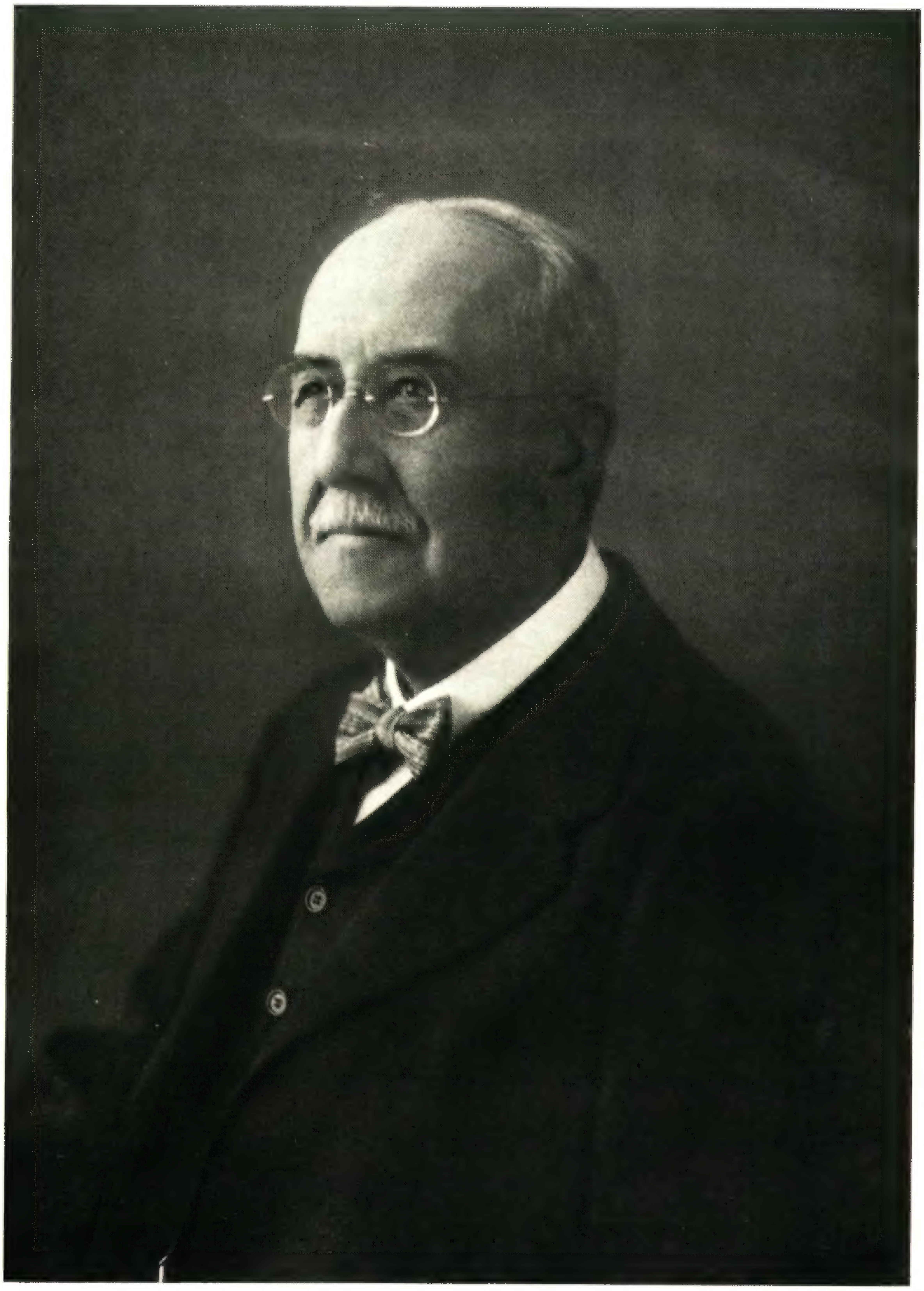

Sincerely Yours
Emile F. Williams

Rhodora

JOURNAL OF

THE NEW ENGLAND BOTANICAL CLUB

Vol. 33. January, 1931. No. 385.

EMILE FRANCIS WILLIAMS[1]

B. L. Robinson

(*With portrait*)

An ability to do something well doubtless exerts on the fortunate possessor an often unconscious allure toward that form of activity. This is particularly true in the choice of avocations and recreative diversions. The late friend, whose remarkable personality and especially whose loyal services to the New England Botanical Club we this evening review, did many things well. His activities were singularly diverse. Into each he threw an energy, skill and good judgment which carried him far. In every one he showed great industry, organizing ability and buoyant enthusiasm. Whether carrying on his business, which dealt with rare oriental objects, or arranging his garden, whether floating out filmy specimens of pondweeds or setting down the complex records of a scientific meeting, planning a dinner for business or scientific associates or writing of medieval French architecture, he brought to the particular task a lively interest and a detailed attention which ensured notable results. In a very rare way he combined practical shrewdness with artistic insight. He was very direct in utterance and often more frank and outspoken in criticism than is usual with New Englanders. Yet he won the life-long regard and affection of many friends. Bilingual from childhood and widely read in two literatures, he retained through life some peculiarities and points of view early acquired in Continental Europe. He was highly individual. His acquaintances knew no one like him. Why was he as he was? Doubtless the best clues can be found in his ancestry and early experiences.

[1] A memorial address delivered before the New England Botanical Club, December 5, 1930.

Emile Francis Williams was born in Boston, January 11, 1858 and died in Cambridge, December 19, 1929. His father, Francis Stanton Williams, a graduate of Harvard College in the Class of 1837, was of colonial New England ancestry, being seventh in the line of descent from a certain Robert Williams, who came, it is thought, from Norwich, England and settled at Roxbury in 1638. The descendants of the immigrant moved first to Newton, then to Hatfield, later to Deerfield, and finally back to Boston and its suburbs. Emile's ancestors were liberally endowed with courage, hardiness, energy and the idealism of their times. Many of them must have been persons of influence in their communities, for the family included a creditable number of captains, majors, colonels, reverends, deacons, doctors and representatives to the General Court. Emile's great great grandfather was a brother of that Col. Ephraim Williams whose legacy led to the founding of the well known college which bears his name.

Emile's father, the son of a Boston merchant, was, it is said, a man of unusual charm. His portraits show him to have had a refined and thoughtful face, suggesting at once a certain austerity and great kindliness. He had mechanical tastes and ambitions as an inventor. Some of his devices are said to have had considerable originality. One of them was a portable railway, planned doubtless to meet military and other temporary needs. It so impressed some of his influential French friends that he was granted an audience by Napoleon III to explain its possibilities. However, inventors rarely possess the business shrewdness to put their devices on a paying basis, and it is by no means surprising that none of Mr. Williams's inventions resulted in a substantial income. So he devoted himself to teaching, first in the public schools of Boston and later in a private and more select school which he himself had organized.

At the age of 39 he married Blanche Henry, some ten years his junior and a language teacher in his school. Notwithstanding the English form of her family name, she was pure French, being the daughter of a distinguished civil engineer of Paris, where she was born and educated. Emile was their first child and was born at Hotel Pelham, which in the Boston of its day stood at the corner of Tremont and Boylston Streets. When little more than two he was taken by his mother for about two years to France and it thus happened that French was his first language. After their return to America the family lived chiefly in Boston but took summer outings in the Con-

necticut Valley at Brattleboro and Windsor, Vermont, and at Deerfield, Massachusetts.

Mr. Williams's school soon began to decline in numbers and in 1865 was given up. He then engaged in some business ventures, manufacturing and selling small filters and other metal devices. In connection with these enterprises he at one time moved with his family to New York and it was there that Emile passed through many of his boyhood experiences, sailing small boats and learning to swim at Staten Island, attending his first opera, beginning piano lessons, and acquiring a certain boyish familiarity with the New York of that period.

When he was nearly ten it was decided that his mother should take him and his younger brother to France for education. The journey was made in November, 1867 on the "Ville de Paris," at that time one of the most luxurious transatlantic liners. Late in life he entertained himself by writing his memories of this journey and with that conscientious attention to detail which characterized all his undertakings he applied to the Compagnie Générale Transatlantique to learn what had been the actual dimensions of the vessel which had made such an impression upon his boyish imagination. He learned that it was a barque-rigged screw steamer 371 feet in length, of about 3000 tons burden and equipped with an engine of only 1250 horse power. Nevertheless, he confidently maintained that this unsteady craft, with its sails set to lessen the rolling, was a thing of beauty beside which the modern steamer would look like a tanker. However, he recalled unfavorably the grotesquely inadequate lighting by dim oil lamps, few in number and extinguished at half past ten, and the distressing lack of ventilation as the wave-swept portholes were not opened once during the trip and even the deck was swept by the stifling smell of hot oil.

On reaching Le Hâvre they found his French grandfather on the wharf and were taken to Paris. There they hired a furnished apartment and Emile was entered in his first French school, the Lycée Bonaparte, as an externe or day scholar. As the term was already well under way he had all the difficulties and mortification of being plunged into the midst of unfamiliar subjects, including intensively taught Latin, with no knowledge of local customs either of work or play. It must have been a harrowing experience to a youngster of ten, sensitive as all boys are to the ridicule of their companions. He soon hated the school so cordially that his mother mercifully had him

transferred, still as a day scholar, to the Institution Kornemann, an establishment conducted by a kindly German couple and attended largely by English and German boys.

On the advice of his grandfather, himself a graduate of the famous École Polytechnique, it was decided that Emile should become a civil engineer and to that end he was entered the following autumn in the preparatory department of the Collège Chaptal, where he made good progress and had special training in mathematics.

Here he was a demi-pensionaire, having his lunch with the other boys. Many years later he would tell of this school, of its strict discipline and definite routine, of its food, mostly huge chunks of hard but delicious French bread and a drink called "abondance," served to the boys in mugs and consisting of red wine and water. He recalled vividly the sports and told how in anticipation of summer the little boys made butterfly nets and the larger ones fish nets, of considerable size, though he confessed that he could not recollect seeing either in successful operation. He told of the seasonal rotation of games, of the swimming baths in the Seine, and of the little shop where fascinating chocolates and other sweets could be bought for a sou or two.

To those fond of Du Maurier his stories singularly recalled the charming pictures of boy-life in the opening pages of "Peter Ibbetson." Paris in those closing years of the second empire, in spite of all deficiencies in heating and lighting, not to mention its unbelievably primitive plumbing, must have been a fascinating place, probably cleaner and gayer than it is today. Baron Haussmann had already cut through most of his spectacular boulevards and the city, quite unconscious of the approaching bombardment and even more terrible Commune, was ambitiously living up to rapidly advancing civic ideals. Parks were being laid out, fountains and statuary set up, and there was even a municipal order that buildings, including private residences, must be cleaned by sand-blast every three years, so, as we are told, the whole city looked as brilliantly white as the Sacré Coeur does now. The Emperor and beautiful Empress frequently drove about in their open carriage in imperial pomp and with many outriders. Even the sergeants de ville were picturesque figures, dressed as they were in silver-trimmed blue uniforms, carrying swords, and wearing great three-cornered hats. There was much to see and to excite the interest of an alert and observant boy who had been reared in a far simpler environment, and there can be no wonder that these years in Paris left vivid and lasting memories.

One summer vacation was spent at a simple cottage on the coast of Normandy near le Hâvre. After this Mrs. Williams and her sons, together with their French grandfather, who had been with them on their outing, returned to Paris and the boys resumed their schooling. Thus the first two and a half years in France passed, on the whole pleasantly, though with minor difficulties. There was need, it is true, for them to practice careful economy. Their ménage had to be very simple and they lived in rooms which could be reached only by climbing four or five flights of stairs and which were perilously cold in winter. There were also, of course, the usual difficulties about service, yet they were in general comfortable and very happy.

Then came in rapid succession exciting and tragic events, introducing a time of harrowing experiences to which Emile in later life referred but rarely and always with deep feeling. The little elderly French grandfather had a stroke of apoplexy from which he never fully recovered. In July 1870 with no adequate preparation, France was suddenly involved in war.

At first there was an almost childish enthusiasm, doubtless artfully stimulated by the governmental agencies of the already tottering empire. There were patriotic gatherings, processions, and speeches, a vast deal of cheering, of cries of "on to Berlin," and of singing of the Marseillaise. The populace was heartened and filled with hectic confidence. The first news spread by the government authorities was favorable, being made up of mendacious accounts of vague victories at the front and of the capture of thousands of German troops and even of the Crown Prince Frederick.

Then penetrated terrifying rumors of actual and very serious defeats. For some time the inhabitants of Paris were kept in harrowing uncertainty, being confronted by the wildest and most conflicting reports. Internal disorders were inevitable. Infuriated mobs began to gather and to threaten the empire. The criminal classes, people of villainous appearance, began to roam the city and to penetrate to its wealthier and more respectable quarters. The enemy was daily approaching with terrifying swiftness and the city was being prepared for siege. Artillery was mounted upon the ramparts, and the trees in the Bois were cut to free from obstruction the range of the guns. At length came the certain news that the Emperor and his army had been captured. Then with much less turmoil than might have been anticipated the empire fell and the republic was set up. In later life

Emile used to take a very natural pride in the fact that he, with his mother and little brother, were actually in the excited throng that watched the commotion on the steps of the Bourbon Palace as Gambetta appeared and read the proclamation announcing this event momentous in French history.

Thereupon changes followed in rapid succession. The Empress escaped to England and in an incredibly short space of time the public buildings were in possession of the new government and workmen with a fair degree of order were chiseling away the insignia of the fallen regime. The street of the 10th of December automatically became the street of the 4th of September, for even in the face of imminent peril from an external enemy the French carried forward their national symbolism.

Mrs. Williams in her anxiety for her elderly and invalided father, whose state of health did not permit his removal, still hesitated to leave the city. Finally, on September 7, her kindly American banker most earnestly counseled immediate flight. She hurried to her apartment, packed three trunks and made such other preparations as possible; while her boys went to take leave of their petit père, as they affectionately called their grandfather. Next day she went for a last time to the bank to get her letter of credit and draw money needful for the journey. The banker again expressed astonishment that she was still there and once more insisted on her immediate departure. Learning of her plans to start at once, he asked how much luggage she intended to take. On hearing of the three trunks, he declared it quite impossible and urged her to take but one or better none, packing only her most valuable possessions and these in hand bags. After hurrying home, she and her boys hastily unpacked the trunks, crammed into one of them and a few pieces of hand luggage the things which seemed most important and thrust the rest, including some of the family silver, into a cupboard which offered no greater security than a very ordinary lock.

Planning to go to Lausanne, where she had friends, Mrs. Williams and her boys, with difficulty engaging a cab, were driven to the Lyons Station. Here all was in hopeless confusion. A dense crowd was milling about and the news had just been spread that no more trains could leave in that direction since the line had already been cut by the uhlans. The mere mention of these much dreaded North German cavalrymen, selected for their speed and armed with lances, was enough to bring the crowd to the last stages of panic.

Mrs. Williams gave up hope of leaving the city and with her boys made her way out of the station intending to return to their apartment. By a great piece of good fortune they found the cab-driver who had brought them and he urged her to try the Gare du Nord, telling her that the crowd was less there and that they might still be able to get a train. The suggestion seemed a good one and they posted across the city. On reaching the Gare du Nord Mrs. Williams endeavored to get tickets to England while Emile and his brother guarded the baggage. The crowd was great and the wait long. On reaching the ticket counter she asked for tickets to London and proffered her money which was in the form of hundred franc notes. She was told that while these would be accepted no change could be given for them. This was perhaps natural at such a time for the fall of the empire had precipitated a money crisis and the value of French paper was at the moment exceedingly uncertain. However, in her nervous excitement Mrs. Williams let her French thrift get the better of her judgment and attempted to argue her rights merely to be pushed out of the line, which was in no patient mood, being made up largely of men trying to escape from France before being drafted for military service.

Before she could again reach the ticket window the London train had departed. Learning that there was still one train leaving for Brussels she was finally able to obtain tickets for that and by good luck succeeded in getting their trunk booked. They were then kept long in the waiting-room and when at length the doors to the platform were opened they found that others more clever had been able by bribing the guards to reach the train in advance and that it was already packed to the absolute limit of its capacity.

When it drew out Mrs. Williams broke down and wept. As Emile used to say, "It wasn't the discreet silent weeping of an American lady in distress but a French flood of tears and wailing." This audible emphasis of woe proved in fact fortunate for it attracted the attention of the sympathetic chief of the station, who upon learning its cause assured Mrs. Williams that a supplementary section of the train was even then being planned and would arrive a little later.

On this, when it came, they were able to get seats in a first class coupé with some courteous and friendly French people as their fellow travellers. When they had stowed away their hand luggage and were, as it appeared, finally settled, Emile suddenly remembered his pocket-

book containing the precious and all important letter of credit, with which he had been intrusted. He hurriedly put his hand into his breast-pocket only to discover that it was gone. His chagrin and consternation it would be difficult to overstate. However, this absolute climax of their woes was quickly followed by joy when on a hurried search about the coupé he found the missing pocket-book on the floor, where it had evidently fallen while he was reaching up to place their bags on the overhead racks.

The journey was long and at times exciting. The tracks were guarded by soldiery, not, as Emile used to explain, to protect outgoing trains but to keep the service open to the last possible moment for the very numerous provision trains bound for Paris in its dire need of supplies for a long siege. With innumerable delays to let these transport trains pass, their express reached Lille about two o'clock at night. There another anxious wait occurred. The station was crowed with troops about to be taken to Paris and of course there was the possibility that the very coaches of their own train might be requisitioned for this military purpose. However, the express at length proceeded, but did not reach Brussels until eleven the next morning.

The city was crowded with thousands of French refugees. The finding of shelter was no easy matter, but Mrs. Williams was lucky in securing two small rooms over a millinery shop. Very soon she and her boys were able to make friends with some pleasant French people who were there in like circumstances. The tiny apartment contained a small American cookstove and Emile soon took part in the preparation of the family meals, developing no small interest and skill in the task. Possibly it was thus that he acquired the very discriminating tastes in foods, flavoring, and seasoning, which he so obviously possessed in later life.

The family was quickly alive to the attractions of Brussels, its picture galleries and its opera, which distinguished French singers in temporary exile were at the time rendering brilliant. In December they were saddened by the death of Emile's grandfather. Information of this reached them from one of Mrs. Williams's sisters, a nun in a convent at Lyons, who had received the news by balloon from Paris. Keen in their French sympathies they followed with much anxiety the events of the war. After the surrender of Paris in January, 1871, and the subsequent close of hostilities they remained some weeks in

Brussels, then seriously considered a return to Paris. Happily they were dissuaded from this by a French friend who had made a trip to the city and correctly sensed its danger. In March the Commune gained control in Paris and during its wild and merciless rule any return to the city was out of the question.

Thoroughly tired of their cramped quarters in Brussels, Mrs. Williams, whose health was far from robust and whose nerves had undergone severe strain, decided to go to Spa and try its waters. This she did incautiously and without medical advice. In consequence she had a really dangerous illness. When she recovered from this, they seem to have enjoyed Spa, rambling in its parks, listening to the music, and watching the gay life at the casino. Mrs. Williams with French tolerance and vivacity was fascinated by the gaming tables and evidently longed to try her luck at roulette or trente et quarante but Emile, influenced by caution or perhaps moved by a puritanic strain in his ancestry, pled with her so earnestly not to do so that she abandoned the purpose. The incident is rather touching, for it shows that even as a boy of thirteen Emile was developing instincts of responsibility.

Before long, they returned to Brussels. In May the Commune met its inevitable fate and republican government was again established in Paris. By July, order had been sufficiently restored and Mrs. Williams took her sons once more to that city. They found their quarters in surprisingly good order, a faithful concièrge having protected their possessions with extraordinary devotion. Of course, every scrap of provisions and every drop of wine were gone, but their other belongings, even their silver, they found where they had so hurriedly left them.

The boys wandered about the city with excited interest observing the many evidences of the German bombardment and the much more serious vandalism of the mobs during the Commune. Sooner than could have been anticipated the schools were resumed, and Emile's studies were continued for two years at the Collège Chaptal, where he made creditable progress and won several prizes.

In July 1873 Mrs. Williams was taken ill. The malady was not at first regarded as serious, but soon became pulmonary and ran its course with remarkable swiftness. She died August 12. Emile's father, notified by cable, came to Paris from America as soon as possible. In the meantime the boys were cared for by an attached and faithful maid servant.

September 27, 1873, Emile with his father and brother embarked for America, not again to visit France for nearly forty-eight years. As soon as feasible he entered the civil engineering course of studies at the Massachusetts Institute of Technology. At first he was somewhat handicapped by language difficulties for his English had grown very rusty during his five years in France and Belgium. Quickly overcoming these he was soon taking good rank in his work and graduated with credit in 1878. During his schooling and indeed for some years afterward he kept, chiefly in French, a rather remarkable diary. From this it is evident that he worked hard but was in no sense a grind, that he was socially disposed and had many friends, that he did not take athletic sports very seriously but was keenly interested in military drill and rifle practice, even receiving some privileges for the observation and study of these matters at the Watertown Arsenal and the fortifications in the Boston Harbor. He followed with much closer attention than most American youths the political and military events which occurred in Europe and often set down in his diary very discriminating comments upon them.

He developed his tastes in music. In this art he had had careful training from childhood and is said in his youth and early manhood to have attained a creditable proficiency on both the piano and, to a lesser degree, the violin. During his school years at the Institute and for some time thereafter he attended an almost incredible number of concerts, operas, oratorios, musical comedies, and plays. The numerous and often entertaining comments upon these which crept into his diary give ample evidence of an artistic appreciation and critical discrimination much beyond what is usual in youth.

On completing his course at the Institute of Technology he found that his father's business affairs were going badly and that money was not available to start him in his engineering profession. Without hesitation he gave this up and threw his energies and organizing ability unto the task of extricating his father from the entanglements of an exceedingly unsatisfactory and disastrous partnership. The period is one about which little can be told as Emile was naturally reticent concerning it. It can only be said that after patient effort he was moderately successful. The relations between him and his father seem to have been at all times those of great affection and sympathetic companionship.

After his father's business had been wound up with as little loss as

possible the pressing need of doing his part toward the family support led Emile to go into business. He entered into a partnership with a second cousin, Arthur Williams, Jr. They undertook the importation and sale of high grade oriental rugs. The partners were very unlike, but perhaps for that reason all the more successful, since they supplemented each other's talents. Arthur, it is said, was a true yankee trader, quick of insight into values and endowed with shrewdness and persistence which enabled him to hold his own even with the wily oriental dealers from whom alone their wares could be obtained. He thus became the effective buyer for the firm, making in this capacity repeated journeys to the near east. Emile, on the other hand, brought to the business exceptional powers of organization and took charge of the sales end of the enterprise with remarkable efficiency. In a very few years the business was thriving. Their shop on Franklin Street soon became widely known, not as a place for cheap bargains, but as one where the highest grade of goods, selected with discriminating taste, could be obtained at fair prices. It was liberally patronized by the best people from all over the country, orders being received from points as remote as New Orleans and San Francisco, and many are the appreciative stories of Emile's frank and kindly advice and of his disinterested anxiety that each purchaser should get something really appropriate to his needs and obtain full value for his money.

As the business expanded a few other articles were added to its scope, chests of Russian caravan tea, jars of choice Indian chutneys, and other specialties of decided rarity in American trade.

With success in business and consequent relief from financial worries, Emile took up new interests. In a modest but discriminating way he began to collect Chinese and Japanese porcelains and bronzes, studying with much zest the periods and dynasties represented by the charming objects which he thus acquired and which rendered his rooms singularly attractive. Always fond of the great out-of-doors he extended his outings and sought recreation in the mountains of New Hampshire and Maine. Whatever he undertook he did with a thoroughness which was at times amusing. Thus for his trips to the White Mountains he provided an equipment so complete and luxurious that he used to refer to himself as a sort of Tartarin. In the course of these excursions he was fascinated by the vegetation and became eager to know more about the trees, shrubs,

flowering herbs and ferns. One day, chancing to see a man seriously engaged in collecting specimens, he stopped and made some inquiries.

The encounter led to acquaintance, which ripened into lifelong friendship, for the man was no other than Dr. George Golding Kennedy of Milton, an enthusiastic amateur botanist, who had been a pupil of Asa Gray himself. Through Kennedy, Williams met Edwin and Charles Faxon, Walter Deane, and the botanists at the Gray Herbarium. His elaborate outfit as alpinist soon gave way to a large vasculum and he began his herbarium which for many years constituted one of his chief interests.

The time was one of notable transition in the progress of New England botany. An era of pioneering activities by such men as Gray, Watson, Brewer and D. C. Eaton, occupied largely with more remote floras, had passed. A younger generation had found opportunities for more intensive work on the vegetation of the northeastern states. Preliminary efforts in this direction had already been made or were approaching completion. Thus the botanists of Essex County, Massachusetts, under the leadership of John Robinson, of Middlesex County stimulated by Dame and Collins, and of Worcester County led by Joseph Jackson, had compiled what for their times were highly creditable local floras. Fernald had revised the Portland Catalogue of Maine Plants, Rand and Redfield were diligently preparing their Flora of Mt. Desert Island, and a group of enthusiastic collectors were in Boston and its suburbs assembling the materials for a flora of the Metropolitan parks, a work which later saw light under the editorship of Walter Deane.

These undertakings brought about acquaintance and coöperation among observers who had previously worked in isolation. The time was ripe for a larger and more formal union of their scattering activities. In the autumn of 1895, among those who were eagerly discussing the feasibility of a regional botanical association, Williams was one of the most confident, energetic and stimulating. Though confessedly a novice in the science, he brought to the undertaking not merely a lively interest but a readiness to serve and to take no end of trouble to secure results.

It happened that some of the older and more influential professional botanists were a bit disposed to hesitancy regarding the enterprise, voicing the view that what Gray himself had not found feasible would not be likely to succeed in the hands of the less experienced. It is a

pleasure to testify that the qualities and influence of Kennedy and of Williams were of crucial value in furthering the plan. To find that amateurs of position and influence were so ready to contribute time and money did perhaps more than anything else to quiet any doubts of its success.

When in December 1895 a preliminary meeting was held at the house of Dr. Farlow, these gentlemen and some dozen or so others were present. In the course of discussion it became evident that Williams had given the matter more careful thought than would have seemed likely. His suggestions showed constructive interest and good judgment. He was therefore included in the committee appointed to draw up the needful constitution for the new organization. At the subsequent meetings of this committee Williams was the competent secretary and the wording of the first constitution of the New England Botanical Club was for the most part of his suggesting, his original draft being cordially adopted after a few minor amendments.

In the very first article of this notable document his personal attitude was strongly reflected. Social by nature he was confident that better acquaintance among the botanists of the region would greatly facilitate their undertakings and do much to stimulate useful coöperation. The article reads: "The New England Botanical Club is established for the promotion of social intercourse and the dissemination of local and general information among gentlemen interested in the flora of New England."

When, about a month later, the Club was actually formed, Williams was elected its Recording Secretary and Treasurer. In this dual capacity he served the Club with remarkable efficiency for some twenty-seven years. In all this time he very rarely missed a meeting either of the Club or of its council. Few forms of literature are more deadly than the ordinary minutes of scientific meetings. Williams's reports on the other hand had real life. One listened to them with actual interest. They are still gratefully remembered by many of the older members of the Club. If he slipped from time to time on minor details and imperfectly caught technical names, such lapses were easy to condone, for he so cordially appreciated the major points of each paper and so tellingly reviewed them in his own words.

He was an effective member of several of the Club committees, especially that of Entertainment. During many years he took part in nearly all the Club's excursions. He collected diligently and con-

stantly perfected his technique. His herbarium grew rapidly and was largely of his own gathering. His specimens were carefully selected, skilfully pressed, beautifully mounted and very neatly labeled.

To him the meetings of the Club were occasions both for the interchange of scientific information and for pleasurable social intercourse, and he certainly did much to make them so. It early became his custom to invite a few special friends to dine with him before the meetings. These informal but elegant little dinners were truly delightful. The perfection of his table linen, china, glass, wine-service and flowers made his table one of exceptional beauty. The pièce de résistance was often of a very unusual character. Among the strange things which, deliciously prepared by his skilful cook, appeared on his table, it is possible at the moment to recall a swan, a mast-fed razor-backed pig of gamey flavor, a porcupine, and a forty pound tortoise. In like manner he sought out and had served at these dinners rare vegetables and fruits. Never himself a large eater, he took a refined interest in his food very exceptional among Americans. Conversation at his table was also exceedingly entertaining and by no means confined to botany,

Williams was a delightful travelling companion. Alert to see and appreciate each object of interest he maintained a cheerful humor even under the most trying circumstances. Until later middle life, when he began to put on weight, he was capable of considerable muscular exertion and took part in some pretty strenuous expeditions such as trips to the less accessible parts of the White and Green Mountains. He was also a member of that party which in the summer of 1900 did much to explore the previously little known slopes of Mt. Katahdin. At later dates he made trips with Professor Fernald and others to northernmost Maine and some of the coastal parts of eastern Maine and Quebec. He was wont to travel with the maximum comfort that circumstances permitted, was always friendly with guides and porters and accustomed to fee with the dignity and liberality of the grand seigneur. In consequence he was always well and cheerfully served. Though he was thus generous by nature and liberal in all his dealings he nevertheless had a horror of all waste. Especially in small matters he had habits of thrift rarely seen in America and doubtless acquired in his early French training.

For some years, through the closed season, several members of the Club used to gather at weekly or fortnightly intervals to discuss bo-

tanical matters and to compare and identify specimens. This little group, which included Williams and Charles Faxon, usually met at Dr. Kennedy's hospitable home in Milton where in his admirably equipped herbarium room, with ample reference material and much of the pertinent literature ready to hand, the conditions for such study were ideal. That Williams in his botanical training profited much by these scholarly contacts is certain. That he added humor and zest to the occasions cannot be doubted.

Williams was a helpful friend to RHODORA from the inception of the journal to the close of his life. Time and again he took the trouble to solicit and collect the funds needful for its successful publication and all his botanical writings were contributed to its pages. These were not very numerous or extensive. They consisted of some fifteen short papers and notes, clearly written and tersely expressed, recording chiefly extensions of plant ranges which he had observed in his collecting. The longest of these published communications were a Comparison of the Floras of Mt. Washington and Mt. Katahdin and a graceful tribute to the memory of Dr. Kennedy who died in 1918.

Williams initiated and carried through many editions the Club Book of the New England Botanical Club, taking no slight care that it should have all the trim neatness and excellent typography of similar records put out by fashionable social organizations. In this, as in many other respects, he firmly insisted that natural science should carefully maintain its dignity.

Early in his botanical activities he became cordially interested in the affairs of the Gray Herbarium. He accepted membership in its first Visiting Committee, chosen in 1897, and was promptly selected as its secretary. His membership on this Committee continued to his death. To his stimulating influence and repeated liberality the establishment is deeply indebted.

June 7, 1904 he married Blanche Emily Wheeler (daughter of George Francis and Alice [Rattray] Wheeler of Concord, Massachusetts), a graduate of Smith College, who was then connected with The Mary C. Wheeler School for young ladies in Providence. She had devoted much attention to classical archeology and had personally taken part in notable excavations in the island of Crete.

After their marriage Mr. and Mrs. Williams for some years made their home in a fine old house on Beacon Hill in Boston. In 1909 they moved to Cambridge where at first they occupied a house with

somewhat extensive grounds. Here Emile had opportunities to try the joys of gardening. In this, as in his other recreations, he showed skill which quickly won the admiration of his friends and neighbors. At a later period they moved to a house which they had purchased in one of the pleasantest parts of Old Cambridge not far from Brattle Street and had remodeled in accord with their tastes and needs. Each of their homes was the scene of delightful hospitalities.

Williams was a loyal member of the St. Botolph Club. He enjoyed its art exhibits, its unusually good library, and its pleasant social contacts; yet he frequented its rooms little in middle and later life. Notwithstanding his social disposition he did not care much for club life. His home, even in his bachelor days, was very perfectly appointed. His books and collections gave occupation and entertainment to him far more interesting than bridge or other club diversions. He was also a member of the Ancient and Honorable Artillery Company, which he regarded with an amused tolerance, taking but rare part in its excursions and festivities. During their life in Cambridge, he and Mrs. Williams were valued members of the Cambridge branch of the American Folk-lore Society, sometimes contributing to its proceedings.

By 1916 his herbarium had reached dimensions which rendered its care an undertaking beyond his available time and energies and he most generously gave it, with his botanical books and pamphlets, including many of the rarer local floras, to the Gray Herbarium, to which it brought a great many useful and highly valued accessions.

The advent of the Great War suddenly threw almost insurmountable difficulties in the way of the importing business in which Emile and his cousin were engaged. Much of the orient, the source of their supplies, was rendered inaccessible. Arthur Williams, who had for some time been in ill health, died in 1919 and Emile, having reached an age when he desired relief from further cares, closed the business, much preferring that it should cease to exist rather than suffer the changes and almost inevitable deterioration threatened by altered conditions.

Though already conscious of some premonitory symptoms which made it desirable for him to restrict his activities, he had habits of industry and he took up new interests. He and Mrs. Williams took an extended journey, crossing the continent and visiting the Canadian Rockies, Mt. Rainier, the Yosemite and other points of scenic or botanical interest. On his return, as will be remembered, Emile gave

the Club a vivacious account of his wanderings and observations. Mr. and Mrs. Williams also spent several summers in European travel, chiefly in central and southern France. Here their familiarity with the language and quick sympathy with the people of the country enabled them to see and appreciate much that would inevitably escape all but the rarest tourists.

As a result of these journeys, undertaken in part from considerations of health and including helpful sojourns at the baths of Royat near Clermont-Ferrand, Emile gathered a considerable mass of notes, records, and selected illustrations relating to the little visited but extremely picturesque and interesting places to which he and Mrs. Williams penetrated. In his last years he devoted himself to the assembling of these in book form.

The resulting work, appropriately called "Undiscovered France," is an imperial octavo of some three or four hundred pages in which a spirited account of the incidents of travel and charms of scenery is skilfully interwoven with the serious presentation of much that is illuminating regarding the history, popular customs, folk-lore, art and architecture of the regions visited. It is not only well written, it is copiously and artistically illustrated. In the vigor of its style there is nothing to suggest that its author was in declining health. Undoubtedly Emile's professional training as an engineer and his long experience with objects of oriental art had given him exceptional powers of observation and judgment both as to architecture and interior decoration.

Happily he was able to carry the work through press and see it in completed form. It was well received and has been the subject of much favorable comment. Perhaps nowhere has it been more keenly appreciated than in the very regions with which it deals, and Mrs. Williams on subsequently visiting some of these places received many touching evidences of the affectionate regard in which her husband was held by the people whose country he had so cleverly and sympathetically pictured.

Of the services which formed the serious undertakings of the life we have been considering, it may be said in brief summary that Williams, in filial loyalty, cheerfully gave up the profession for which he had spent his youth in preparation, and devoted more than ten years to his father's assistance, that he then in conjunction with his cousin substantially aided the commerce of his city by building up and for

some thirty years carrying on a business enterprise that became probably the best of its kind in the country, that he developed one of the finest amateur herbaria in America, that he gave much thought and untold hours to the aid of botany, helping to found and conduct the New England Botanical Club, notably assisting its journal and generously aiding in important ways the Gray Herbarium, and that finally in his elderly years he prepared an illuminating contribution to the literature of travel,—truly an impressive aggregate of accomplishment.

Regarding the subjective side of his life, we may confidently infer that it was a very happy one. Beyond the ability of most human beings he found the world "full of a number of things"—of things charming to hear, delightful to see, delicious to eat, of things fascinating to study and to collect, of friends to cheer and of enterprises to aid. Never seeming to hurry, always ready for sociability, he filled his life with an amazing richness of diverse interests, each skilfully pursued to results of value.

THE FORMATION OF PEAT RIDGES ON THE SHORES OF MUSKEG LAKES IN NORTHERN ALBERTA[1]

HUGH M. RAUP

THE shores of certain lakes in the central part of the Mackenzie River basin show series of peat ridges parallel to the water's edge. They have been observed and studied by the writer in the basin of Moose Lake ("Eight Lake" on the most recent maps[2]), approximately in latitude 59° 35′, longitude 113°. The lakes on which they were seen are shallow and have very gently sloping, marshy shores. Some have only one ridge, one to two feet high, while others show several, of similar height, extending at intervals back from the water. These do not occur continuously, but in broken lines, more accentuated in some places than in others.

The diagrams, FIG. 1, and the photograph, FIG. 2, show the general arrangement of the vegetation on the shores. The primary species are noted, and the details will be only summarized here. The associations of emergent aquatics are of four or five kinds. The ones inhab-

[1] Published during the tenure of a National Research Fellowship in the Biological Sciences, and by permission of the Director, National Museum of Canada.

[2] Dept. of the Interior of Canada, Topographical Surv., National Topographic Series, Sheet No. 84 P. (Peace Point) July, 1929.

iting the deeper water, dominated by *Potamogeton praelongus* and *Nymphozanthus variegatus* (*Nymphaea variegata*), are either nearly pure stands of these species, extended over wide zones, or contain only a few secondary species which are not conspicuous. The growth is not a dense one, being easily penetrated with boats. The only approach to a denser growth in the deeper water occurs with the insertion of the fifth type on some very shallow and protected shores. Here *Fluminea festucacea* and *Carex trichocarpa* var. *aristata* make close, nearly pure stands.

In shallower water, about one and one-half feet deep, and always a few yards off-shore, there is a comparatively narrow association of which *Scirpus validus* is dominant, making a thick, nearly impenetrable stand. There are frequent openings in this zone, so that it is not continuous along the shore. It is characterized by a larger number of secondary species than is shown by the associations described above: *Utricularia vulgaris*, *U. minor*, *Potamogeton Richardsonii*, *P. zosterifolius*, *P. Friesii*, *P. pusillus*, *Myriophyllum exalbescens*, *Sparganium* sp. (floating seedling), a floating moss, *Hypnum* sp., and an abundant plankton. The bottom is of decaying vegetation, through which it is possible to thrust a stick to a depth of about one and one-half feet to a solid substratum.

The shallow area between the *Scirpus* and the actual shore line is comparatively open water. Patches of *Myriophyllum exalbescens* make the commonest vegetation. Where a peat ridge rises abruptly at the edge of the water it has a plant cover dominated by *Salix planifolia*, *S. myrtillifolia*, and *Calamagrostis inexpansa*. Otherwise there is usually a *Typha latifolia* association of very dense growth followed by one in which *Carex diandra* is the most important species. The latter zone is very wet, having considerable standing water between the sedge tussocks. Farther back from the shore line there is drier ground, and colonizing *Calamagrostis inexpansa*, *Salix planifolia*, and *S. myrtillifolia*, with an association which, under normal conditions, passes to a *Picea canadensis* forest on still higher ground.

Where shore drainage is less complete, a *Picea mariana-Ledum groenlandicum* muskeg is developed instead of the *Picea canadensis* forest. Peat ridges observed on these shores develop a mixed type of vegetation, as shown in FIG. 1. *Salix myrtillifolia*, *Picea mariana*, *Larix laricina*, and *Calamagrostis inexpansa* are the primary species. The ridges, whatever their vegetation, are separated from each other

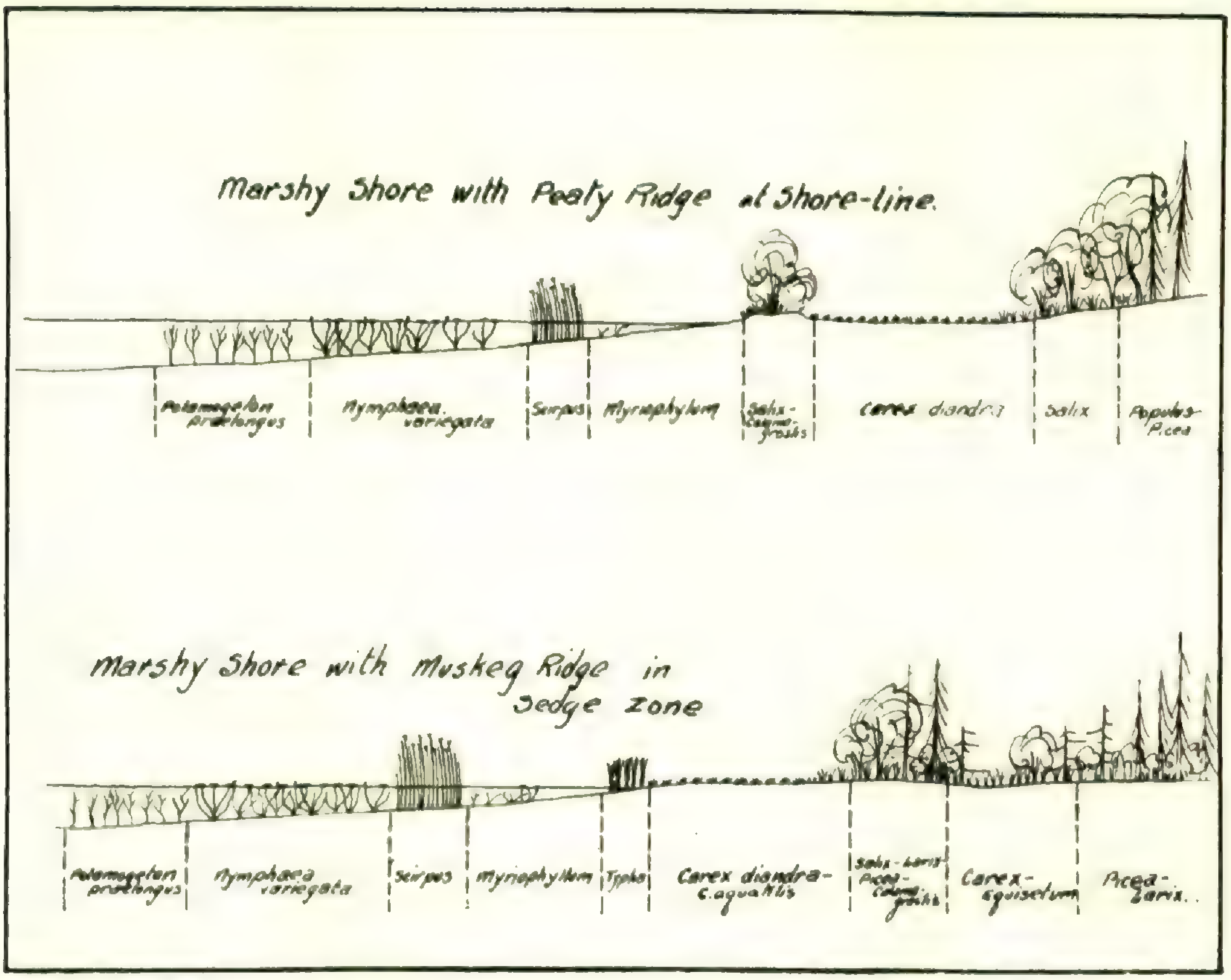

FIG. 1. Sections of the vegetation and peat ridge formations on the shore of Moose Lake, Aug. 1929.

FIG. 2. Aerial photograph of Seven Lake, showing the zonation of the vegetation on its shores. (Reproduced through the courtesy of the Director of Civil Aviation, Department of National Defense, Ottawa, Canada.)

or from more mesophytic associations by marshy, sedge or *Equisetum* zones.

From the above brief discussion it is evident that there are only two places in the shore zonation where there are particularly abundant sources of peat. These are in the *Scirpus* and *Typha* associations, where there is either a very dense growth of the primary species, alone or with an abundant stand of secondary species. It should be noted that these associations are in comparatively narrow, roughly parallel, discontinuous lines, separated by shallow water containing a scant vegetation.

During the retreat of the Pleistocene ice from the Athabasca-Great Slave Lake basin, a series of lakes, dammed by the ice front, formed in the major river valleys.[1] When the water stood at about the 1100-foot level the Moose Lake basin was entirely beneath the surface, and terminal moraines were forming at the ice front to the east. With the further retreat of the ice, and the opening of the lower Mackenzie drainage, the water was lowered to about the 800-foot level. The terminal moraines above mentioned, with others of the same age or older lying south of Moose Lake, appear to have held back a part of the former lake in the depression now occupied by Moose and Bog Lakes and many other unnamed bodies of water. The western boundary of this lake was on the eastern slope of the Caribou Mountains, while its northern extent is not ascertained. How long it lasted cannot be measured with present knowledge, but its age as a large lake was determined by the length of time required by its main drainage streams, the Little Buffalo and Jackfish Rivers, flowing to Great Slave Lake and Peace River, respectively, to cut through the morainic barriers that dammed them.

That this process of the lowering of the water level has been carried on until very recent time, and is probably still in progress is shown by the writer's observations and by those of Camsell.[2] The latter, in describing a muskeg area near Moose Lake, wrote, "Judging by the shells on the muskeg, the whole must have been covered with water at no very remote period;" and again, referring to Bog, or Thul-tue,

[1] For a discussion of these post-glacial lakes and their relations to the distribution of the vegetation see: Cameron, A. E. *Post-Glacial Lakes in the Mackenzie River Basin, Northwest Territories, Canada.* Journ. of Geol. xxx. 337 (1922). Raup, Hugh M. *The Distribution and Affinities of the Vegetation of the Athabasca-Great Slave Lake Region.* Rhodora, xxxii. (1930).

[2] Camsell, Charles. *The Region Southwest of Fort Smith, Slave River, N. W. T.* Geol. Surv. Can., Ann. Rept. xv. 156A and 163A (1903).

Lake, "At one time the lake probably extended over all the river valley as far down as the last mentioned rapids, for the whole of this part lies in a well defined valley and is still very wet and marshy and covered with swamp grass and willows . . . . . The deepening of the channel at these rapids, however, caused the water to drain off, lowering the lake to its present level and shore line." On the western slopes of the Nini-sheth Hills, a part of the moraine lying northeast of Moose Lake, there are faint indications of abandoned sandy beaches which marked the shore of the ancient lake. An old portage trail from the Little Buffalo River to Moose Lake does not reach the lake shore by several hundred yards, approaching nearest it at the bottom of a deep bay which is now nearly filled with a wet slough vegetation. This was a summer trail, and from its appearance has been long in disuse. The cuttings are very old ones and there are long discarded remains of birch bark canoes about the lake shore. It is probable that the trail has not been used in summer for many years, and that since its use the lake has experienced a permanent fall of one or two feet in water level, with the growth of a wide marsh between the present shore and the old landings. If the present condition had existed when the trail was formerly used, the Indians would undoubtedly have made their landing on a point at the north of the embayment, which it is now necessary to do.

Such a drop in the level of the lake, occurring on the shores previously described, would expose for the acquisition of a new plant cover the peaty accumulations in the *Scirpus* and *Typha* associations. Occurring as ridges, these would have fairly good drainage and would soon develop the semi-mesophytic vegetation of *Salix* and *Calamagrostis* with their secondary associates, or, in muskeg surroundings, a combination of these with *Picea mariana* and *Larix*. The present open, shallow water associations between the ridges would become *Carex diandra* zones, involving in some situations *C. aquatilis*, *C. rostrata*, and *Equisetum limosum*.

Causes for the formation of the peat ridges, therefore, appear to be in the selection of certain definite zones of the shore habitat by *Scirpus validus*, *Typha latifolia*, and their associates, with the consequent differential accumulation of vegetable remains, and in the recent lowering of the level of the lake to expose the ridges thus formed.

Lewis, Dowding, and Moss have described with considerable detail the arrangement of *Larix* and *Betula glandulosa* on ridges which occur

at muskeg margins in central Alberta.[1] They suggest that these ridges may have been formed partly by the lowering of the water level in the bog, and partly by the greater accumulation of peat on the ridges due to a richer growth of vegetation. It may be that the initial stage of this condition was similar to that now existing in the more recently developing muskegs of the Moose Lake basin.

Gray Herbarium,
Harvard University.

Scirpus pumilus in the Rocky Mountains.—One of the most localized sedges of North America is the little species, *Scirpus pumilus* Vahl (1806) or *S. alpinus* Schleicher (1828), which was recently found on the Mingan Islands and Anticosti by Victorin and Rolland. In a most interesting discussion of its occurrence there Bro. Victorin[2] cites in America, besides the stations on the Gulf of St. Lawrence, only an old specimen of *Hall & Harbour* from an unidentified locality in the Rocky Mountains. In examining the sheets in the Gray Herbarium in the covers of *Eleocharis pauciflora* (Lightf.) Link or *Scirpus pauciflorus* Lightf. I find two collections of characteristic *S. pumilus* from comparatively low altitudes in the Canadian Rocky Mountains. One, distributed as *S. pauciflorus*, is in splendid condition and the essential data on the label are: marsh, Devil's Lake, Banff, Alberta, alt. 4600 ft., July 5, 1907, *Butters & Holway*, no. 50; the other, an over-ripe series, came from the herbarium of the late C. F. Wheeler and had been correctly identified by him: from Laggan, British Columbia, August 23, 1902, alt. 5000 ft., no. 1057 (collector not stated). Still another Rocky Mountain station, not cited in the recent discussion of the plant, was recorded in 1892 by Dr. Britton. Besides the Hall & Harbour collection Britton cited one from "Morley, British Columbia, Rocky Mountains (Macoun, 44)."[3] The Banff and Laggan stations, supplementing that at Morley, suggest that search in herbaria may show that *Scirpus pumilus* has an extensive range in

[1] Lewis, F. J., Dowding, E. S., and Moss, E. H. *The Vegetation of Alberta II. The Swamp, Moor, and Bog Forest Vegetation of Central Alberta.* Journ. of Ecol. xvi. 31–35, Pls. iii. and iv., Fig. 2 (1928).

[2] Victorin, *Additions aux Cypéracées de l'Amerique du Nord.* Trans. Roy. Soc. Can. ser. 3, xxiii. pt. 2, sect. V. 253—reprinted as Contrib. Lab. Bot. Univ. Montr. No. 15: 253 (1929).

[3] Britton, Trans. N. Y. Acad. Sci. xi. 75—reprinted as Contrib. Herb. Columbia Coll. no. 26: 2 (1892). This record presumably was the basis of the inclusion of the species in Rydberg, Fl. Rocky Mts. 109 (1917).

the northern Rocky Mountains. Farther southwest, it is found in the Sierra Nevada of California.[1]—M. L. Fernald, Gray Herbarium.

International Botanical Address Book.—At the Fifth International Botanical Congress at Cambridge, England, it was voted to prepare and publish an international address book of botanists. The Committee in charge of the project is Professor L. Diels, Director of the Botanic Gardens, Berlin-Dahlem, Dr. E. D. Merrill, Director of the New York Botanical Garden, and Dr. T. F. Chipp, Assistant Director of the Royal Botanic Gardens, Kew. All botanists desirous of inclusion in the Address Book should prepare at once the proper entries on a card 3 × 5 inches and modeled after the specimen below:

Name and initials:	Gleason, H. A.
Professional qualifications:	M. A., Ph. D.
Office:	Curator
Address:	N. Y. Botanical Garden, Bronx Park, N. Y.
Special interests:	Taxonomy; Flora of tropical South America

The cards should be immediately forwarded to the appropriate member of the Committee: in America, Dr. E. D. Merrill, N. Y. Botanical Garden, Bronx Park, N. Y.

Volume 32, no. 384, including pages 259 to 299 and title-page of the volume, was issued 18 December, 1930.

[1] Abrams, Ill. Fl. Pacific States, i. 272 (1923).

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THE NEW ENGLAND BOTANICAL CLUB

Vol. 33. February, 1931. No. 386.

CONTRIBUTIONS FROM THE GRAY HERBARIUM OF HARVARD UNIVERSITY.—NO. XCIII

SPECIFIC SEGREGATIONS AND IDENTITIES IN SOME FLORAS OF EASTERN NORTH AMERICA AND THE OLD WORLD[1]

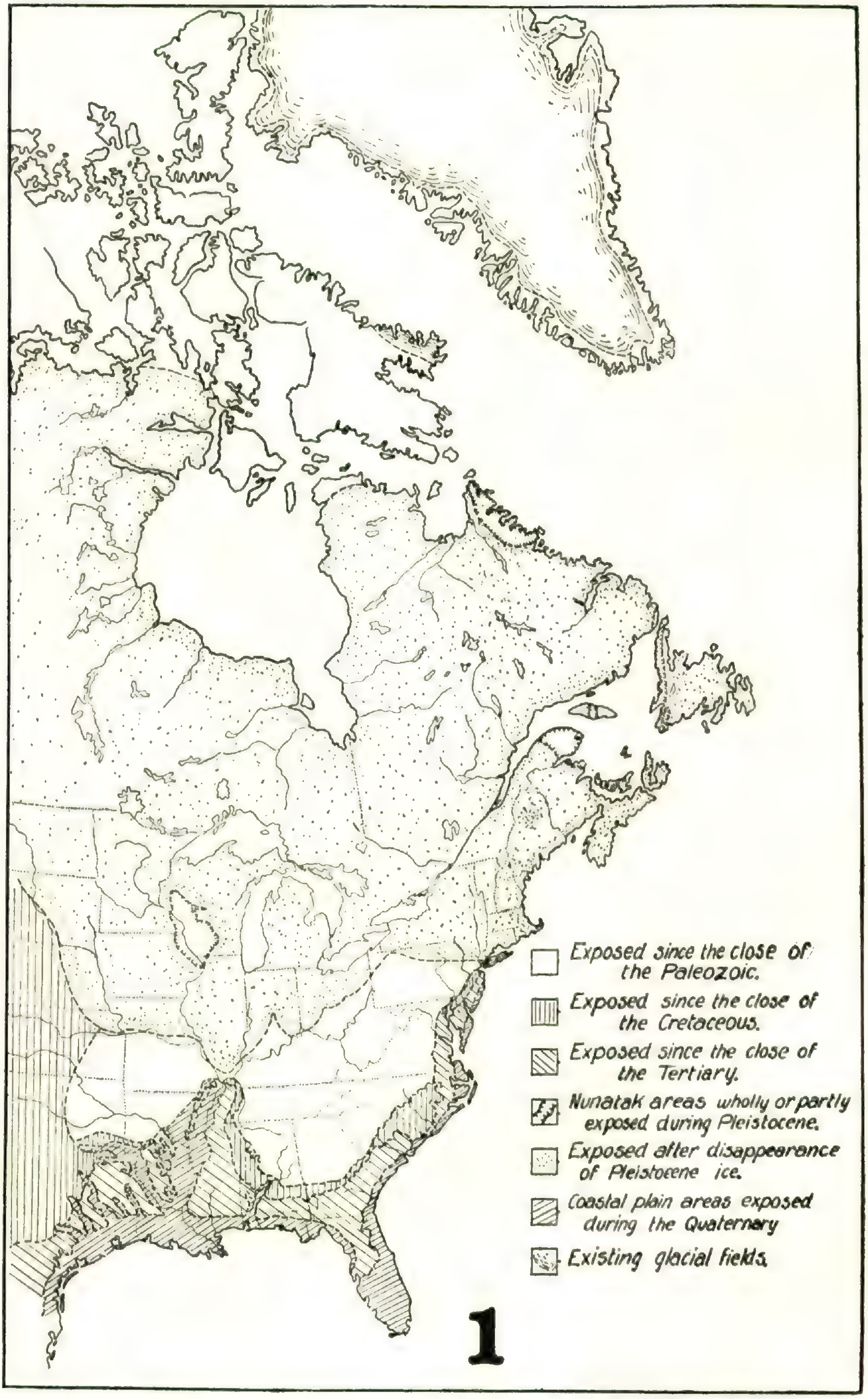
M. L. Fernald

(Plate 204)

I HAVE assumed that I am expected to base my discussion primarily on some features of phytogeography which I have personally examined, rather than to attempt extensive generalizations concerning floras with which I am absolutely unfamiliar. Granted this assumption, I must start with a consideration of problems centering on a limited area of eastern North America, the region of the Atlantic slope extending from the Labrador Peninsula to the Atlantic States and the Mississippi Valley (MAP 1). This district, however, is sufficiently extensive clearly to exhibit large areas which, since the dawn of Angiosperms, have had quite different physiographic and floristic histories.

Viewed from the standpoint of availability for occupation by flowering plants, the oldest large section of the region is the southern half of the Appalachian Upland, extending from central New York to northern Georgia and northern Alabama, and west of the Mississippi represented by the Ozark Plateau. Never, since it was first occupied

[1] Originally announced under the above title for the joint Discussion on *Geographical Distribution and its Relation to the Concept of Species* of Sections E (Phytogeography and Ecology) and T (Taxonomy and Nomenclature) but, at the invitation of the Executive Committee, expanded and presented (under an abbreviated title) in the General Programme of the Fifth International Botanical Congress at Cambridge, England, Thursday evening, August 21, 1930.



Map 1, Periods of Availability for Plant-Occupation of Eastern North America since the Paleozoic.

by Angiosperms, has the Appalachian Upland of the United States (and Canada) been invaded by seas; and, except for its northern extension, it lies wholly south of the limits of the Pleistocene glaciation. During the Cretaceous, while this southern half of the Appalachian region was covered by land-vegetation, the lower marginal country, east, south and far to the west and northwest, was submerged under the Cretaceous seas. In the Tertiary, likewise, much of the low-lying Coastal Plain was again covered by shallow seas; and, furthermore, the outer margin of the Coastal Plain is often of very modern or Quaternary origin.

North of the southern Appalachians and extending north to northern Labrador and the subarctic and arctic continental coast is the area which was covered by Pleistocene ice, the last advance of which, the Wisconsin, is estimated to have begun its frontal decay only 25,000-30,000 years ago, while the northern limit of this advance in eastern America is represented by the living glacial field of eastern Baffin Island and the almost continental ice-cap of Greenland. Although the Wisconsin or most recent continental ice-sheet in the median latitudes of North America and its confluent valley-glaciers together denuded or modified a vast area, there are several nunatak areas known, where the last glaciers did not develop or where their work was so restricted as to leave essentially undisturbed some regions of mountains, high plateaus and precipitous headlands and, in the famous "driftless area" of Wisconsin, Illinois, Iowa and Minnesota, even of prairie. In the area we are specially considering the most notable of these nunataks[1] or regions unglaciated or only slightly denuded by the last continental ice-sheet are the Torngat Mountains, just south of the eastern entrance to Hudson Strait, large areas of Newfoundland, especially centering on the Long Range near the West Coast, the eastern half of the Gaspé Peninsula of Quebec, and some other smaller and isolated spots about the Gulf of St. Lawrence.

Temperate eastern North America has, then, an extensive area (the southern Appalachian Upland) in which land-plants have had an opportunity to spread since the advent of Angiosperms; others (limited portions of the inner Coastal Plain and much of the central plain of the United States) where living floras could have taken possession only after the withdrawal of the Cretaceous seas; others (much of the

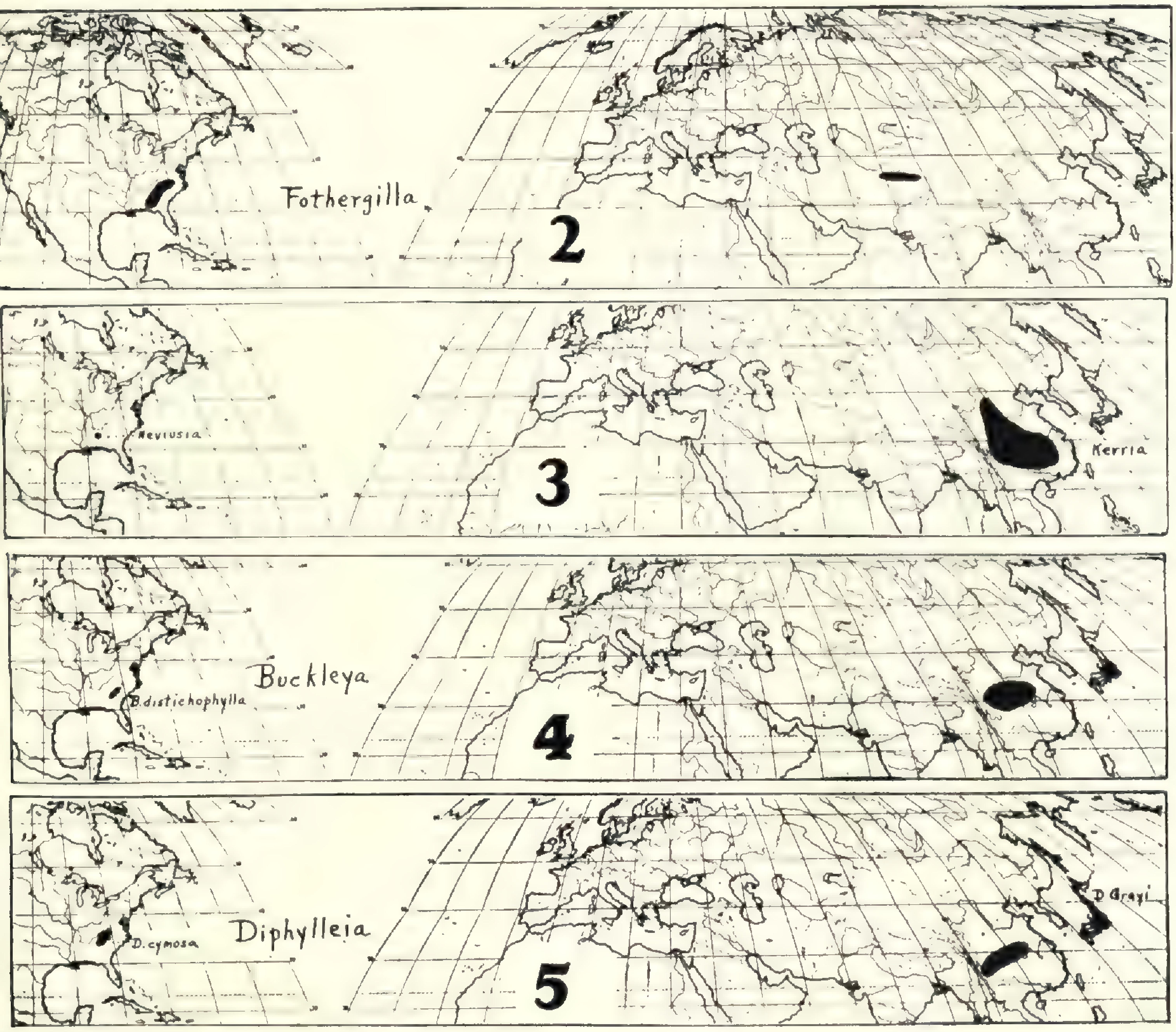
[1] For enumeration and discussion of these areas see Fernald, *Persistence of Plants in Unglaciated Areas of Boreal America*, Mem Amer. Acad. xv. No. III. (Mem. Gray Herb. ii.) 295–317 (1925).

Atlantic and Gulf Coastal Plains) unavailable to land-plants until the tipping off of the Eocene and the Miocene waters; others (the nunatak areas) which apparently retained their present distinctive floras through at least the last glaciation; still another, the largest of all, the vast region of Canada and the Northern States which has become available for wholesale occupation by plants only since the decay of the Wisconsin ice, within the last few thousand years; almost as young or in some regions even younger, scattered areas at the outer margin of the Coastal Plain, of very recent or Quatenary origin; and, youngest of all, the million or more square miles cleared and fundamentally altered by the white man during the last three centuries.

These strongly contrasted periods of availability to plant-populations of different eastern American areas are, of course, closely paralleled in other regions: for instance, in Europe, with the western third of the Iberian tableland uninvaded by the Cretaceous and the Tertiary seas which drowned much of the continent; others, like much of the Mediterranean basin, largely unavailable until the withdrawal of the Tertiary seas; and still others, such as southern Scandinavia, only a few thousand years removed from submergence under the Great Baltic Glacier. The distinctive floras which characterize the different physiographic areas of temperate eastern North America are very definite, and it is my purpose, in so far as time will allow, to direct attention to the different degrees of specific segregation shown, especially by the amphigean or the world-wide genera in these different floras.

In the ancient Appalachian Upland of the United States the outstanding phytogeographic feature is, of course, the great mesophytic forest of Mesozoic or early Cenozoic genera, many of them formerly found likewise in Europe, western America and the Arctic but now restricted to one or more areas of eastern North America, eastern, central or southwestern Asia[1] or the geologically ancient peninsulas of

[1] The identity or close similarity of angiospermous genera of eastern Asia and eastern North America was recognized as early as 1750 by Halen, a student of Linnaeus, who, in his thesis, *Plantae Camschatcenses Rariores*, pointed out (in § V) several such cases—see L. Amoen. Acad. ii. 336 (1751) This relationship has subsequently been frequently emphasized and many typical examples are well known. Consequently, only a few illustrations, perhaps less generally familiar, are here enumerated. Other cases are discussed in the following papers by myself: *The Geographic Affinities of the Vascular Floras of New England, the Maritime Provinces and Newfoundland*, Am. Journ. Bot. v. 228 (1918); *Isolation and Endemism in Northeastern American and their Relation to the Age-and-Area Hypothesis*, Am. Journ. Bot. xi. 570 (1924); *The Antiquity and Dispersal of Vascular Plants*, Quart. Rev. Biol. i. 222, 227, 229 (1926); *Some Relationships of the Floras of the Northern Hemisphere*, Proc. Intern. Congr. Pl. Sci. ii. 1489 (1929).



Map 2, Geographic Range of FOTHERGILLA; 3, of KERRIA, and its American Representative, NEVIUSIA; 4, of BUCKLEYA; 5, of DIPHYLLEIA.

southeastern Europe: *Fothergilla* (MAP 2)[1] with a few excessively rare species in the southern Appalachians and one on the wooded slopes of Kashmir and adjacent Afghanistan; *Hamamelis*, with wide-ranging eastern American species and localized Asiatic representatives; *Magnolia*, highly developed in both southeastern North America and southeastern Asia; *Neviusia* (MAP 3), like an apetalous representative of the local Chinese *Kerria*[2] and known only from a very restricted station in the foothills of Alabama; *Pachystima, Stewartia, Symplocarpus, Panax, Shortia, Phryma, Triosteum* and scores and scores of others. It was this vast assemblage in the southern Appalachian

[1] The world-maps used to show ranges of plants in this paper are made on Goode's Homolographic Projection, published and copyrighted by the University of Chicago.
[2] *Kerria japonica* DC., in spite of its specific name, is endemic in China.

region as well as the remarkable relics on the Coastal Plain of the United States which stimulated Guppy, congratulating American students upon the superabundance of these ancient types still living and picturing the emotions of a student appreciative of his opportunity, to write:

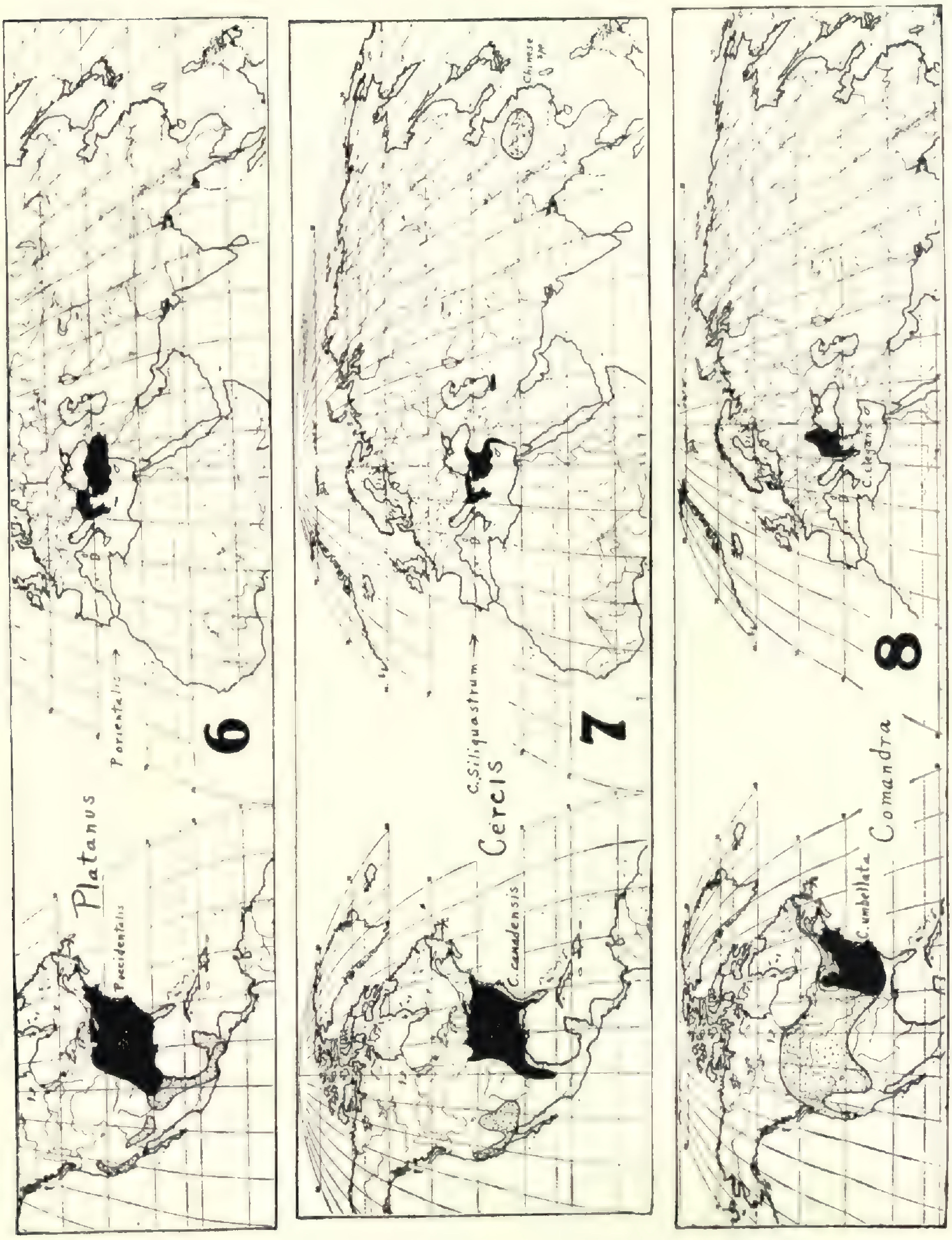
"In the woods around him were growing the Liquidambar, the Sassafras, and other shrubs and trees that had flourished in the Mesozoic ages in the spot where he was standing. Their remains crowded the Cretaceous deposits exhibited in the cliffs near by. Specimens of the past and of the present were in his hands. Though the difference in kind was very slight . . . the difference in time, measured in human lives, amounted to eternity. It is a story of perpetuity rather than of change . . . He begins with the cosmopolitanism of such types in the Cretaceous age and he ends with their more restricted distribution and somewhat greater specialization now. . . . Those old genera become the genera of today; and the genera of today, though the genera of a thousand ages, are 'but as yesterday' in the history of flowering plants."[1]

Not only, as Guppy so vividly stated, are these Appalachian genera of today the genera of a thousand ages; their species are also ancient and usually sharply differentiated. No one with good material would fail to distinguish the two or three local Japanese and Chinese species of *Buckleya*[2] from the famously rare American *B. distichophylla* Torr. (map 4), the latter American shrub parasitic on the roots of *Tsuga*, the American *Menispermum canadense* L. from the Asiatic *M. dauricum* DC., the extremely local American *Cladrastis lutea* (Michx.) K. Koch from the Japanese *C. platycarpa* Mak. and the other Asiatic species; nor such herbs as the highly localized Appalachian *Diphylleia cymosa* Michx. (map 5) from the less localized Asiatic *D. Grayi* F. Schmidt, or the American *Podophyllum peltatum* L. from the Asiatic *P. emodi* Wall. Such illustrations of this eastern Asiatic-eastern American generic similarity but specific differentiation could be increased by hundreds but these must now suffice.

Turning to genera, subgenera or sections shared by Appalachian America and eastern or southeastern continental Europe, we again get sharp specific differentiations: the Old World *Platanus orientalis*

[1] Guppy, *Fossil Botany in the Western World: an Appreciation*, Am. Journ. Sci. ser. 4, xlix. 372 (1920).

[2] For memoranda on the Asiatic ranges of *Buckleya* and some other genera I am indebted to the kindness of Dr. Handel-Mazzetti.



Map 6, Geographic Range of Platanus; 7, of Cercis; 8, of Comandra.

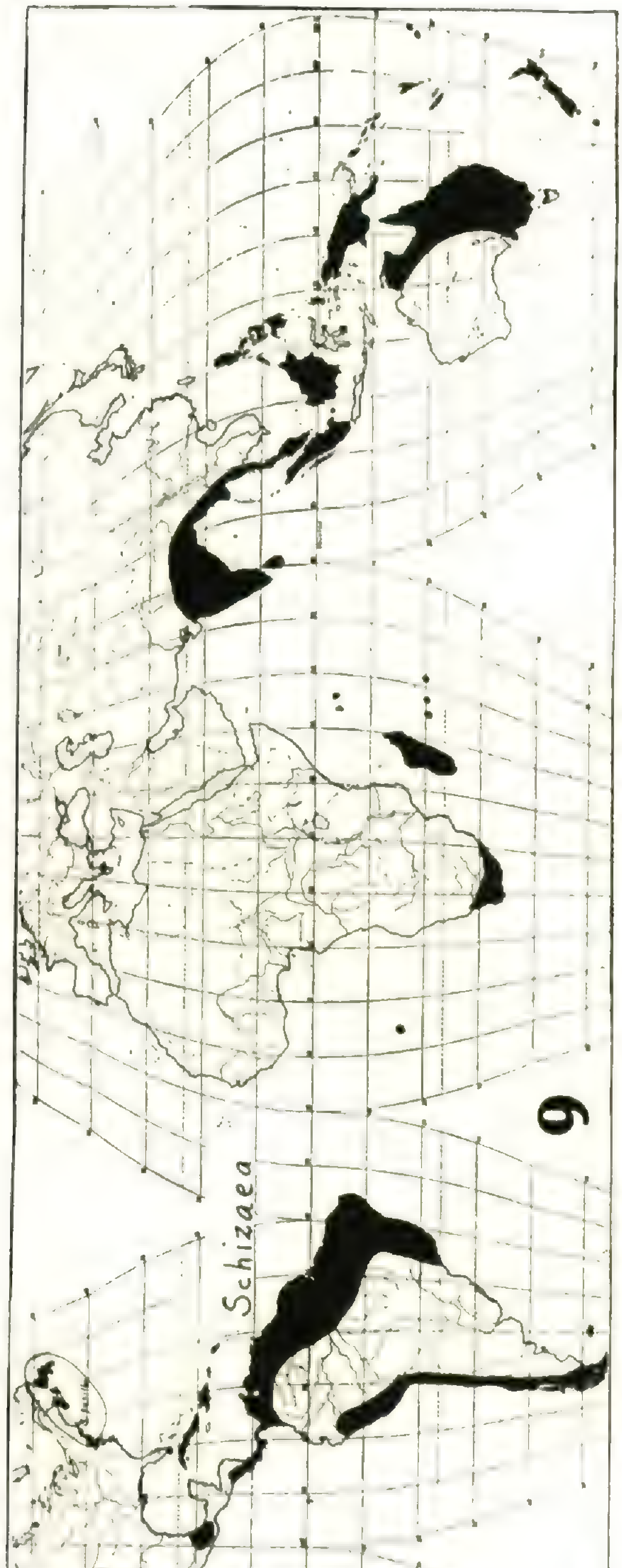
L. (MAP 6) and the American *P. occidentalis* L. (with some related trees farther west); the Appalachian *Anemone lancifolia* Pursh, which has generally been confused with the European *A. trifolia* L. but which differs[1] in constant details of the flowers; the Eurasian *Cercis Siliquastrum* L. (MAP 7) and the American *C. canadensis* L., with other species in western North America and in central China; the common American genus *Comandra* (MAP 8) with a single Eurasian representative, the comparatively localized *C. elegans* (Rochel) Reichenb.; and so on through dozens of groups, the southeastern European and the eastern American species usually having western North American representatives as well. In the cases just cited the Appalachian and the Old World species are sharply distinguished, but there are a few (perhaps a dozen) cases of Angiosperms (and still more in the Pteridophytes) where the differentiation of species is not so complete, the eastern American and the Asiatic plants being considered by some systematists as recognizable species, by others as merely geographic varieties: such cases as *Tovara virginiana* (L.) Raf., *Polygonum sagittatum* L., *Liriodendron Tulipifera* L.,[2] *Phryma Leptostachya* L. and *Aruncus sylvester* Kosteletz.; while in a few cases, such as *Symplocarpus foetidus* (L.) Nutt. and *Monotropa uniflora* L., search has failed to reveal even significant varietal differences. Admitting these very few exceptions (which will become significant when we have examined the historical relation of the mesophytic Alleghenian flora to the prevailingly xerophytic and hydrophytic Coastal Plain groups), however, when the hundreds of species of Appalachian angiospermous genera are compared with their Old World representatives the general conclusion is

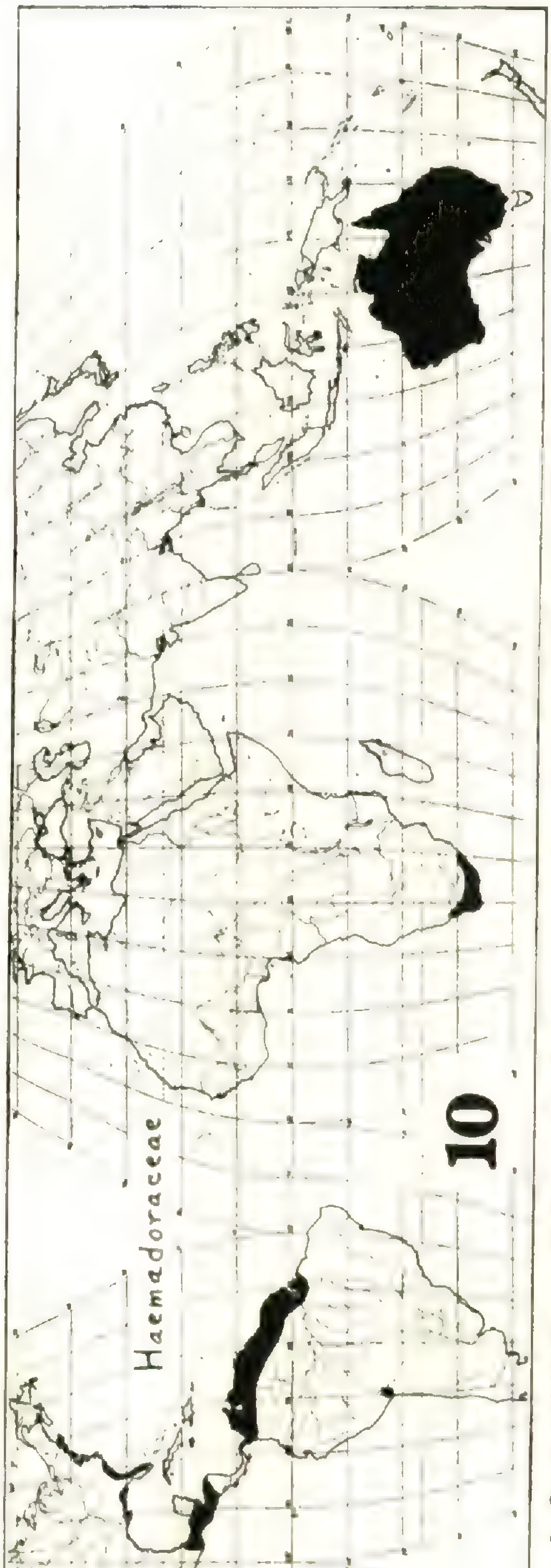
[1] See Fernald, RHODORA, xxx. 184 (1928).

[2] There is a very general impression that *Liriodendron* is one of the most ancient of Dicotyledons and that its antiquity is demonstrated by its having occurred in Greenland during the Cretaceous. The error involved has been well summarized by Seward: "Among the numerous species of Dicotyledons are some which it has been customary to refer to the genus *Liriodendron*, now represented by the Tulip-tree of North America and China. A recent examination of specimens [from Greenland] of these simple, emarginate 'leaves' has convinced me that they are the leaflets of a compound leaf, a conclusion which had previously been reached by some other palaeobotanists who have examined specimens from North American and European Cretaceous rocks. In a recently published book on 'Tree Ancestors,' the American palaeobotanist, MR. E. W. BERRY, speaks of the occurrence of *Liriodendron* in Greenland, but I venture to think that there is no satisfactory evidence in support of this statement. Though it is not possible from the available material to refer the leaflets to any one recent genus with complete confidence, the probability is that they belong to compound leaves of a plant closely allied to some existing species of *Dalbergia* or possibly *Pterocarpus*, genera with a wide geographical distribution in the tropics and both occupying a similar position in the Leguminosae."—Seward, *Arctic Vegetation Past and Present*, Journ. Royal Hort. Soc. l. pt. 1: 15 (1925).

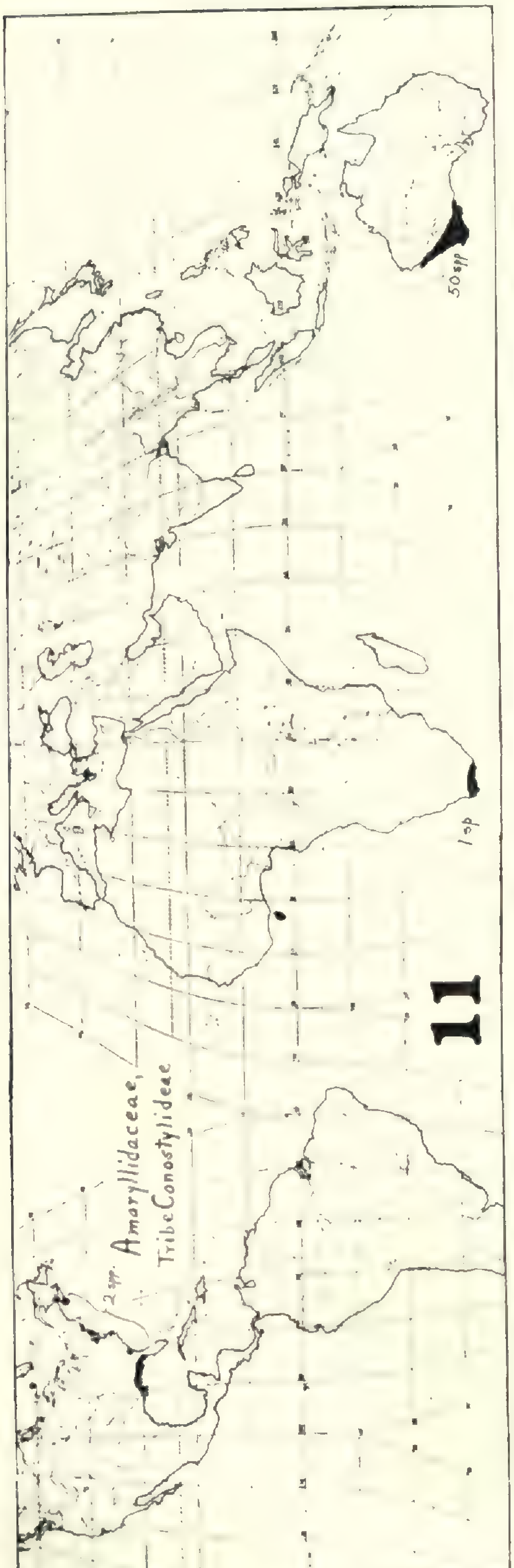
apparent: that in nearly all groups the species of the Western Hemisphere are completely segregated from those of the Eastern; that we here have stable or essentially stable specific entities.

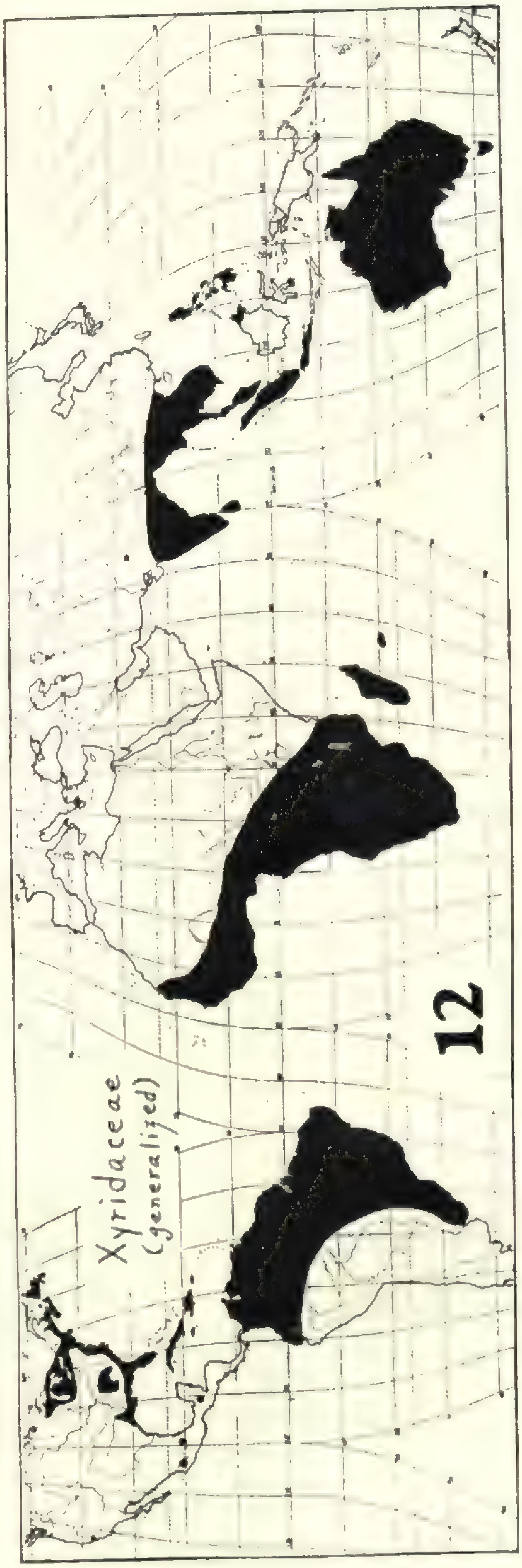
Descending to the broad outer Coastal Plain of Atlantic North America, the region of silicious and acid peaty soils of Tertiary or later origin, we come to a change in the flora so striking as immediately to challenge attention; for, whereas the distinctive non-endemic genera of the southern Appalachian region are those shared with temperate eastern and central Asia or with southern or eastern Europe, the Old World elements in the indigenous Coastal Plain flora of Atlantic North America are prevailingly the groups with wide tropical and subtropical range, the families, tribes, genera and sections shared by the Americas with tropical and subtropical Africa, tropical and subtropical Asia, and Australia but for the most part unknown in temperate Europe and largely unrepresented in temperate Asia. For instance, if I may be permitted to leave for a moment the Angiosperms and to draw an illustration from the Pteridophytes, the ancient genus *Schizaea* (MAP 9), with 20–25 species confined to the Southern Hemisphere and the Tropics, in the Old World unknown north of Madagascar, the Seychelles, India and the Philippines; in the New World wanting north of tropical Mexico and subtropical Florida, but with the single famous exception, *Schizaea pusilla* Pursh. This solitary northern species was long supposed to be restricted to a limited area of the northern Coastal Plain, in New Jersey, but we now know that the regions of its wide-spread abundance are the peats of more northern Nova Scotia and still more northern Newfoundland; *S. pusilla* on the latter island being a typical species both of the highest unglaciated tablelands and of the lower regions recently covered by Wisconsin ice. Very similar tropical or austral relationships are shown by the majority of non-endemic genera and tribes of Angiosperms (and especially of Monocotyledons) on the Atlantic Coastal Plain: the *Haemadoraceae* (MAP 10) restricted to Australia, South Africa, tropical America and the Atlantic Coastal Plain north to Massachusetts; the tribe *Conostylideae* (MAP 11) of the *Amaryllidaceae* with 50 species in southwestern Australia, 1 in South Africa and 2 in eastern North America, the American species both excessively local but one of them extending north to Nova Scotia; the *Xyridaceae* (MAP 12) confined to the Southern Hemisphere and the Tropics except for an extension northward along the eastern margin of North





Map 9, Geographic Range of Schizaea, S. pusilla in ellipse; 10, of the Haemadoraceae.





Map 11, Geographic Range of the Amaryllidaceae, Tribe Conostylideae; 12, of the Xyridaceae.

America quite to latitude 50° in Newfoundland, with a slight isolation inland in the north about the Great Lakes and an area of disrupted colonies (of *X. torta* Sm.) on the 4000-foot silicious tablelands of the southern Appalachians; and so on with prevailingly tropical or austral groups like *Lophotocarpus, Eriocaulon, Hypoxis, Drosera* (MAP 28), *Galactia, Lilaeopsis*, the *Pontederiaceae, Burmanniaceae, Podostemaceae* and hundreds of other groups.

Although the eastern American representatives of the tropical and austral groups are there now concentrated on the soils of Tertiary, Quaternary or even Pleistocene origin, they are by no means restricted to the comparatively youthful areas. Here and there along the ancient tableland-crests of the Appalachian system, wherever the primitive, open xerophytic or hydrophytic conditions prevail and where the denuding action of the Pleistocene ice was not too severe, we are learning to expect rare and highly localized members of the so-called Coastal Plain flora, like *Xyris torta* (MAP 31) just referred to. Through Mesozoic time the Appalachian Mountains of the present day did not exist as mountains but, as Berkey succinctly puts it, "The continent stood much lower than now. Portions that are now mountain tops and the crests of ridges were then constituent parts of the rock floor of the peneplain not much above sea level. . . . Such conditions prevailed over a very large region—certainly all of the eastern portion of the United States."[1] The following, from among the very numerous corroborative statements, are representative of the consensus of geological opinion. "Jurassic time throughout the greater part of North America was one of erosion. . . . This erosion cycle brought about the final transformation from the old topographic expression of high Appalachian . . . mountains to a nearly base-leveled land."[2] "Once more there was prolonged quiet. The fault-block mountains were persistently attacked by the erosive agents and were reduced [in early Cretaceous], like their Appalachian predecessors, to an almost plane surface, close to sea-level."[3] "It is known as the 'Cretaceous Peneplain,' because of its best development during the Cretaceous period. This vast plain extended over the areas of the Appalachian Mountains, Piedmont Plateau, all of New York state, the Berkshire Hills, and the Green and [the] White Mountains. . . . . The Cretaceous period was closed in eastern North America

[1] Berkey, N. Y. State Mus. Bull. no. 146: 67 (1911).
[2] Schuchert, Historical Geol. 846 (1915).
[3] Daly, Our Mobile Earth, 297 (1926).

by a disturbance which produced an upwarp of this vast Cretaceous peneplain with maximum uplift of from 2000 to 3000 feet . . . to produce a broad dome sloping eastward and westward, and northward to the Gulf of St. Lawrence and southward to the Gulf of Mexico."[1]

And studies by the geologists farther north clearly indicate that the peneplained or baseleveled condition of the ancient mountain-axes extended at least to Newfoundland and apparently to northern Labrador, if not beyond. For example, Alcock, reporting on the Shickshock Mountains of Gaspé, famous, like the tablelands of western Newfoundland, for having stood undisturbed above the local ice-sheets of the Pleistocene,[2] says: "Gaspé peninsula . . . is a region of Appalachian structure, . . . The interior of the peninsula is a plateau dissected by deep valleys . . . The most striking feature is, probably, the mature character of the upland topography . . . the sky-line is comparatively even in all directions. . . . Gaspé peninsula, therefore, is a region which must have been base-leveled and, later, uplifted and dissected. . . . A youthful topography, represented by these steep-walled valleys, is superimposed upon the old age topography of the upland surface."[3] Similarly, Twenhofel, whose intimate knowledge of the physiography of the region is unequaled, says: "To one approaching Newfoundland from Sidney [Cape Breton] . . . , the most impressive feature is the high flat-topped upland, here rising almost vertically from the sea. . . . If Newfoundland be observed from the Labrador side, one feature will attract and maintain the attention: the flat-topped upland, standing boldly and prominently in view. . . . The sky line of the Long Range is strikingly horizontal and the appearance of an equal height in all its parts is not a fiction resulting from a distant view, for it remains the same near as well as far. . . . The accordance of the summit levels of the highlands, . . . the presence of well preserved flat-topped mountains at many localities with the projected plane of their summits

[1] Miller, Historical Geol. ed. 3: 278, 279 (1928).

[2] "There is no evidence that glaciers worked on the highest parts of the Shickshock mountains"—Coleman, *Physiography and Glacial Geology of Gaspé Peninsula, Quebec*, Can. Dept. Mines, Geol. Surv. Bull. 34 (1922); "The Shickshock Mountains, though occupied by local glaciers during the Pleistocene, escaped the erosion of the continental ice sheets."—Alcock, *Across Gaspé*, Geogr. Rev. xiv. 208 (1924); "the southern part of the Long Range . . . seems to have remained as an area free from ice on which pre-glacial plants could survive."—Coleman, *The Pleistocene of Newfoundland*, Journ. Geol. xxxiv. 220 (1926).

[3] Alcock, *Geology of Lemieux Township, Gaspé County, Quebec*, Geol. Surv. Can. Summ. Rep. 1921, Pt. D, 76, 77 (1922).

truncating all kinds of structure and rock, . . : these are considered evidence of the present dissection, but one time perfection of a peneplain, a plain of erosion of remarkable perfection extending over the whole of Newfoundland. . . . . On this ancient plain the rivers were free to wander where they would, ... They probably crossed the site of the present mountain ranges and, when the land arose, each stream struggled to maintain its position. . . . In the eastern United States throughout the Appalachians, the existence of an extensive peneplain, completed before the end of Cretaceous time, is now universally admitted and with this base level that of Newfoundland is tentatively correlated, and the period of development and close of the cycle assumed to be the same."[1] Beginning with the close of the Cretaceous and continuing, with minor interruptions, through Tertiary time this floor of ancient Appalachian rock, only slightly above sea-level, was gradually uplifted and deeply weathered and sculptured to produce the Appalachian Upland of today; and as the upwarping of the older land progressed the marginal region, which had been overlapped by the shallow Tertiary seas, was also elevated, tipping off the Tertiary waters and extending the emerging continent a full 100 miles (160 kilometers) eastward to the margin of the now submerged continental shelf. The American geologist, Miller, thus puts the matter: "The uplift of the great Cretaceous peneplain was an event of prime importance for the eastern United States, because it literally furnishes us with the beginning of the history of most of the existing relief features of the Appalachian district as well as New York and much of New England. Hence we assert, with emphasis, that all the principal topographic features of this region as we see them today date from the uplift of the Cretaceous peneplain, because they have been produced by the dissection of that upraised surface. This dissection was largely the work of erosion. . . . . All the valleys, great and small, such as the Champlain, Connecticut, Mohawk, Hudson, the Great Lakes valleys, and the valleys of the Appalachians, have been produced since the uplift of the peneplain."[2]

In view of this well attested physiographic and ecological change of the Appalachian Upland, from a baseleveled or coastal-plain status, with sluggish drainage and innumerable shallow pools and boggy de-

[1] Twenhofel, *Physiography of Newfoundland*, Am. Journ. Sci. ser. 4, xxxiii. 7, 18, and 19 (1912).

[2] Miller, Hist. Geol. ed. 3: 326–329 (1928).

pressions through much of the Cretaceous, to its present elevated and deeply dissected condition, it is certainly significant that in favorable habitats at different points on the now uplifted ancient peneplain we find relic-colonies of such tropical or austral genera as *Schizaea*, *Lygodium*, *Stenophyllus*, *Eriocaulon*, *Xyris*, *Lobelia* and that peculiar terrestrial group of *Utricularia*, sometimes treated as a genus, *Stomoisia*, with 50 species in tropical Asia, Africa, Australia, eastern South America and eastern North America; and mingled with the typical lowland plants of tropical or austral affinity on the high Appalachian crests and tablelands we sometimes find similar relic-colonies of characteristic endemic American genera of the Atlantic Coastal Plain: *Orontium*, *Xerophyllum*, *Helonias*, *Calopogon*, *Cleistes*, *Sarracenia*, *Hudsonia*, *Rhexia*, *Leiophyllum*, *Bartonia* and numerous others. *Schizaea pusilla* of the Pine Barrens of New Jersey and of the peaty barrens of Nova Scotia and Newfoundland occurs, likewise, on the highest unglaciated tablelands (the uplifted Cretaceous peneplain so much enphasized above) of Newfoundland. My first experience with it was on the diorite tableland of the Blomidon Range, my published note reading: "Among the tufts of *Scirpus caespitosus* . . . was the famous little fern of the New Jersey Pine Barrens, *Schizaea pusilla*. . . . . Here at 2000 feet altitude it abounded over many acres, nestling in the bases of the *Scirpus* tussocks."[1] Fifteen years later the great student of Pleistocene geology, Coleman, visiting Blomidon, wrote: "From this [1,560 feet] to the highest point reached (1,700 feet) . . . there was no evidence of glaciation."[2] *Lygodium palmatum* (Bernh.) Sw., the only living member of this tropical genus now found on the Appalachian tablelands, has upland stations scattered from western New England to Tennessee; *Eriocaulon septangulare* With., *Xyris montana* Ries, *Lobelia Dortmanna* L. and *Utricularia* (*Stomoisia*) *cornuta* Michx. abound in pools on the tablelands of Newfoundland, there often associated with *Schizaea pusilla;* the *Eriocaulon*, *Xyris*, *Utricularia* and *Lobelia* also occurring, along with the Coastal Plain *Lygodium palmatum*, *Orontium aquaticum* L., *Amianthium muscaetoxicum* (Walt.) Gray, *Aletris farinosa* L. and *Rhexia virginica* L. on the tablelands of Pennsylvania.[3] *Xerophyllum asphodeloides* (L.) Nutt. and *Zigadenus leimanthoides* Gray, ordinarily Coastal Plain plants, have long been known from the high tablelands of North

[1] Fernald, Rhodora, xiii. 133 (1911).
[2] Coleman, Journ. Geol. xxxiv. 210 (1926).
[3] Porter, *Flora of the Pocono Plateau*, Rhodora, i. 183–185 (1899).

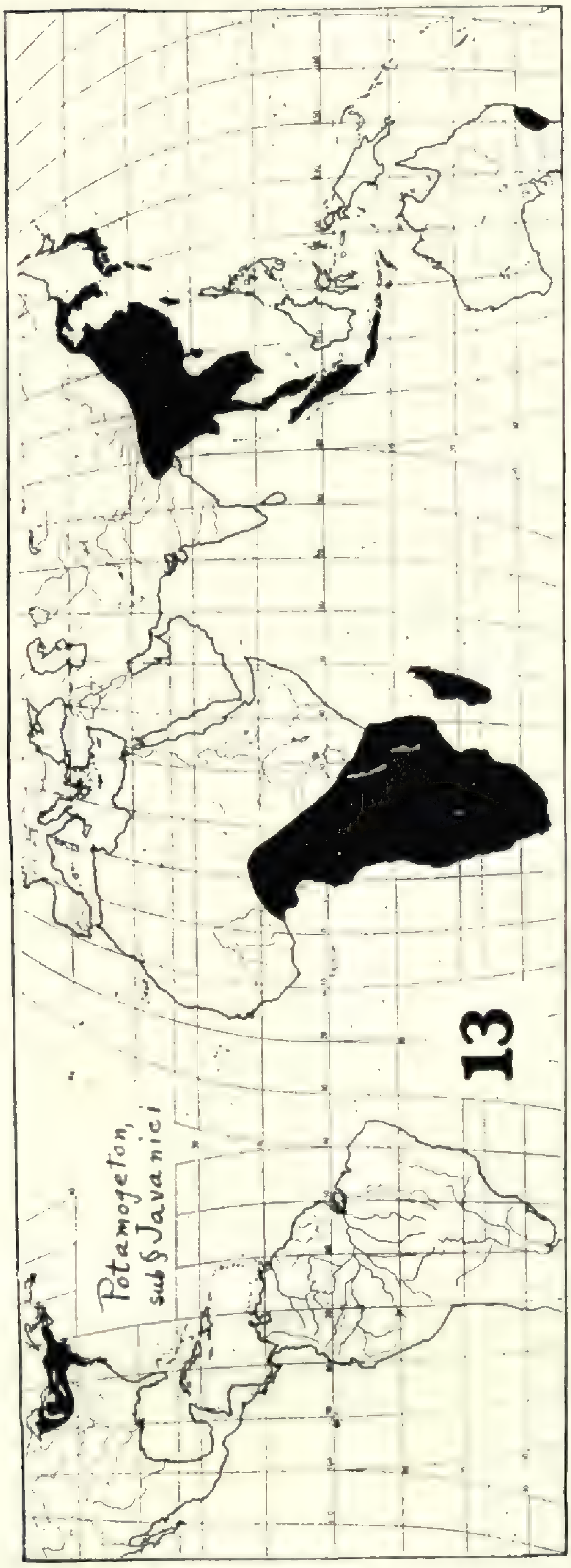
Carolina; *Leiophyllum prostratum* Loudon and *L. Hugeri* (Small) K. Sch. are the Appalachian crest representatives of the Coastal Plain *L. buxifolium* (Berg.) Ell. *Helonias bullata* L., for nearly two centuries supposed to be endemic on the Coastal plain, was found[1] in 1909 on the mountains of western North Carolina; and *Cleistes divaricata* (L.) Ames (*Pogonia divaricata* R. Br.), also considered a typical species of the Coastal Plain, is well known from high tablelands of the southern Appalachians.[2] In fact, this relationship of the Coastal Plain and the Appalachian tablelands has long been known. Thus, in 1879, Redfield, describing the Carolina mountain trip with Canby, Gray, Hyams and Sargent, wrote: "on the 12th was made the ascent of Table Rock, a most remarkable summit, belonging to the Blue Ridge system, presenting in one direction the tabular profile which gives it its name, and from another a sharp conical outline not unlike that of the Matterhorn. The botanists returned from it laden with plants, and it was curious to see among them so many of the species which are associated with the sandy barrens and swamps of southern New Jersey."[3]

In some cases plants of Australian, Malayan and African affinity are now found in America almost wholly in the North, in the region which was largely under the Pleistocene ice. This most unlooked-for disruption of range is well illustrated by *Potamogeton*, sub § *Javanici* (map 13), the group of dimorphic plants which Hagström considered the most primitive of pondweeds with floating leaves The members of this primitive subsection occur locally in Australia, more generally from Java to Japan and Burma, on Madagascar and across southern and central Africa; but outside these tropical and subtropical areas of the Old World the *Javanici* are known only as two extremely rare species, so rare that each new station is heralded as a notable range-extension, *Potamogeton Vaseyi* Robbins and *P. lateralis* Morong, confined to a limited region of the northeastern United States and adjacent Canada. A very similar disruption is displayed by *Myriophyllum*, § *Tessaronia*, the plants of *Eumyriophyllum* with four, instead of eight, stamens, plants of tropical and subtropical India, Madagascar and eastern North America, but with a slight representation also in Pacific North America.

[1] House, Muhlenbergia, vi. 73 (1910).

[2] Gattinger, Tenn. Fl. 84 (1887); Small & Heller, Mem. Torr. Bot. Cl. iii. no. 1: 10 (1892); Kearney, Plant World, i. 35 (1897); Wherry, Journ. Wash. Acad. Sci. xviii. 213 (1928).

[3] Redfield, Bull. Torr. Bot. Cl. vi. 335 (1879).

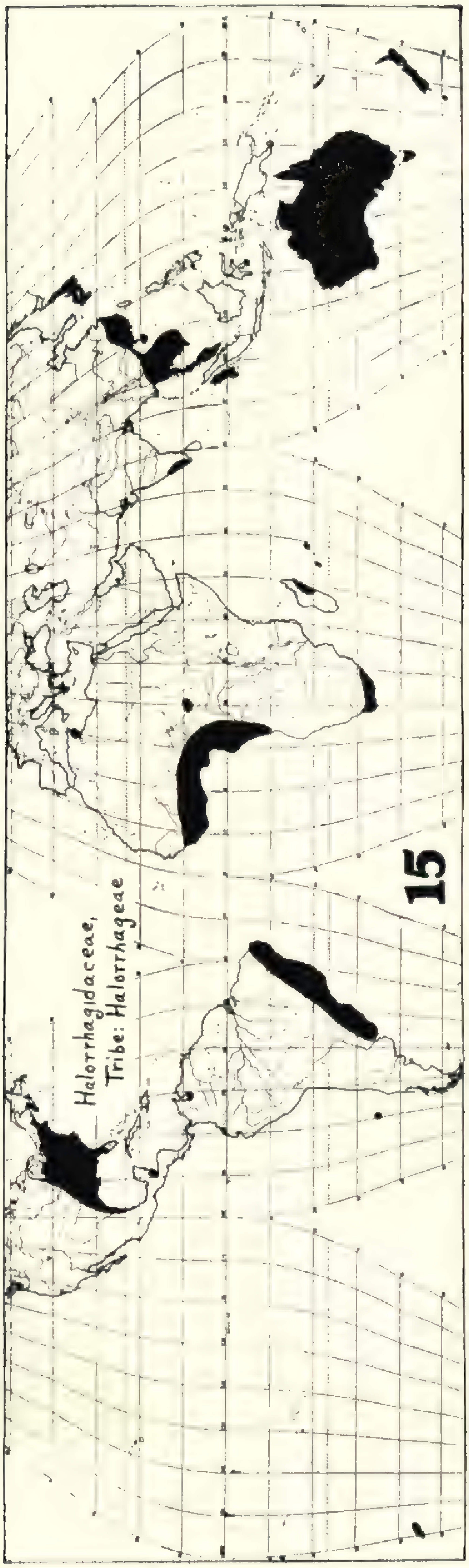


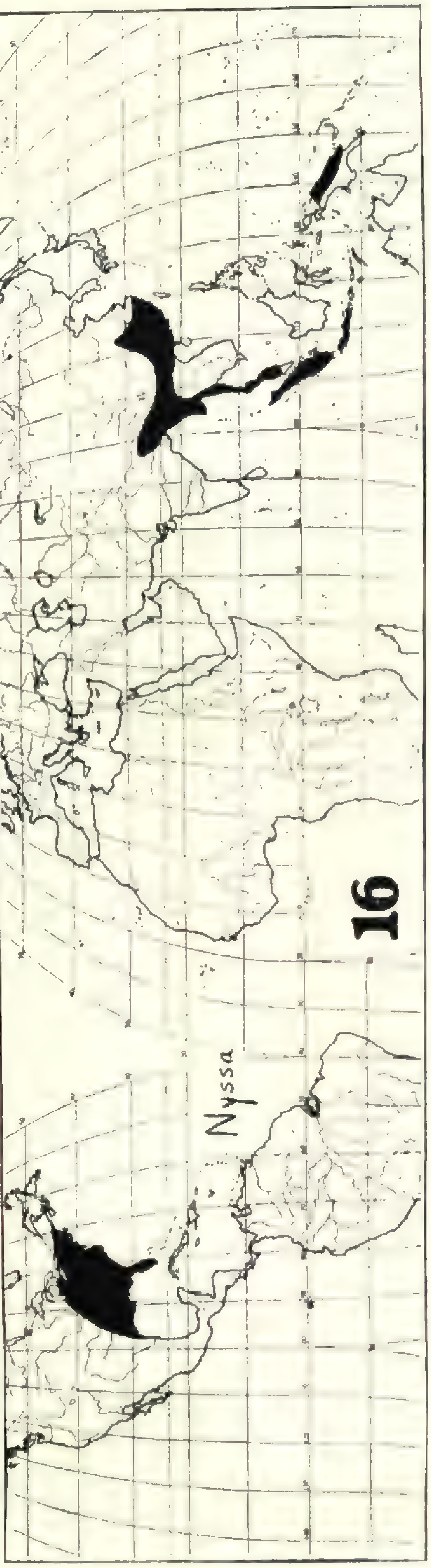
Map 13, Geographic Range of Potamogeton, sub § Javanici; 14, of Diospyros.

Whether the wide-ranging herbaceous angiospermous groups of the Atlantic region of North America were Mesozoic or early Cenozoic genera of the whole Northern Hemisphere, which have subsequently restricted their ranges principally to the Tropics, we cannot now absolutely demonstrate. As herbs they have left few if any fossils; but Carboniferous, Jurassic and Cretaceous members of the *Schizaeaceae* occurred in Europe and northern Asia, even in arctic Spitzbergen;[1] and the ligneous and consequently easily fossilized genus *Diospyros* (MAP 14), which today has an essentially tropical distribution quite comparable with the present ranges of *Schizaea, Lygodium, Potamogeton*, sub § *Javanici, Lophotocarpus, Xyris, Eriocaulon*, the *Burmanniaceae* (MAP 18), the *Droseraceae* (MAP 28), the *Halorrhagidaceae*, tribe *Halorrhageae* (MAP 15) and hundreds of other groups (except that, unlike them, *Diospyros* is considered indigenous also from northern India to the Caucasus and the Black Sea), in mid-Cretaceous covered practically the whole Northern Hemisphere, quite to the Arctic. Berry's vivid account is to the point: "In that grand display of dicotyledonous genera which during the mid-Cretaceous replaced the old Mesozoic flora of ferns, cycads, and conifers and which appeared with such apparent suddenness at a number of points in the Northern Hemisphere, we find unmistakable evidence of the abundance and wide distribution of species of Diospyros. No less than 17 different forms have been described from the rocks of this age, and the localities where they have been found are scattered from Australia to Bohemia, Greenland, and Vancouver Island . . . . they seem to have been especially at home along the Cretaceous coast of the Atlantic and along the border of the Mediterranean Sea which extended northwestward from the Gulf of Mexico over much of our present Great Plains area."[2] In other words, their greatest display of Cretaceous fossils is in the margin of the area covered by the Cretaceous seas, which then bordered the baseleveled land which in the Tertiary became uplifted and dissected to form the present Appalachian Upland with its characteristic climax mesophytic forest. Very similarly, ligneous *Nyssa* (MAP 16), today with a disrupted range somewhat similar to that of *Myriophyllum*, § *Tessaronia*, formerly had a broad range across Eurasia and North America, reaching Spitzbergen and

[1] See Potonié in Engl. & Prantl. Naturl. Pflanzenfam. i.[4] 372 (1900); also Seward, *A Study in Contrasts: The Present and Past Distribution of certain Ferns*, Journ. Linn. Soc. xlvi. 233, 234 (1922).

[2] Berry, Tree Ancestors, 257 (1923).





Map 15, Geographic Range of the Halorrhagidaceae, Tribe Halorrhageae; 16, of Nyssa.

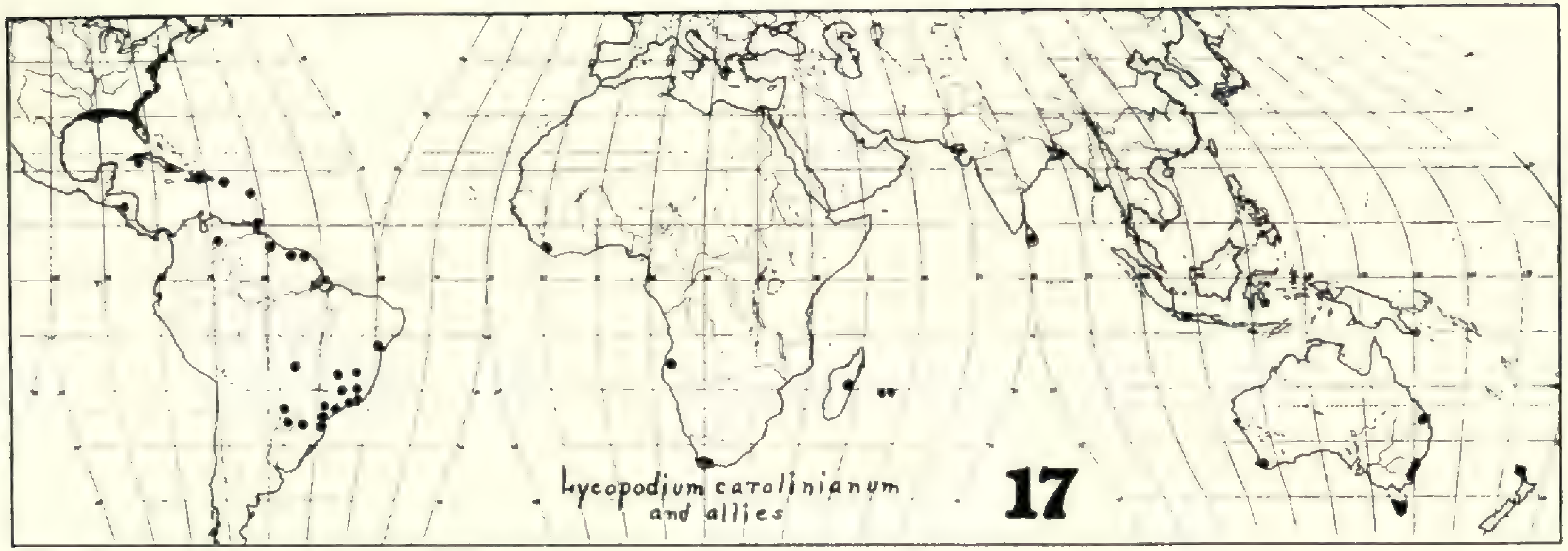
Greenland. Again drawing upon Berry's *Tree Ancestors:* "A large number of fossil forms of gums have been described . . . found in Upper Cretaceous deposits in Wyoming, Nebraska, Kansas, and Alabama. During the early Tertiary gums are extraordinarily abundant. . . . It is worthy of comment that all of the Upper Cretaceous and Eocene gums are North American or Arctic, . . . In the far north they occurred at that time in Alaska, Greenland and Spitzbergen."[1] This present restriction primarily to the Tropics of groups formerly wide-spread in the Arctic has been summarized by our President in a single sentence: "A study of ancient floras reveals the capacity of plants as travelers; many flowering plants, conifers, and ferns that are now confined, or almost confined, to the tropics of the southern hemisphere were in the Cretaceous and Tertiary periods represented by species widely spread over the northern hemisphere, passing far within the Arctic Circle."[2] And all of us will call to mind groups, prevailingly tropical today, which are also characteristic of temperate Atlantic North America and which have a few northern representatives in Europe as well: *Eriocaulon, Echinodorus, Fuirena, Fimbristylis, Mariscus* (*Cladium*), *Smilax*, the *Dioscoreaceae*, *Hibiscus* and *Ammania.*

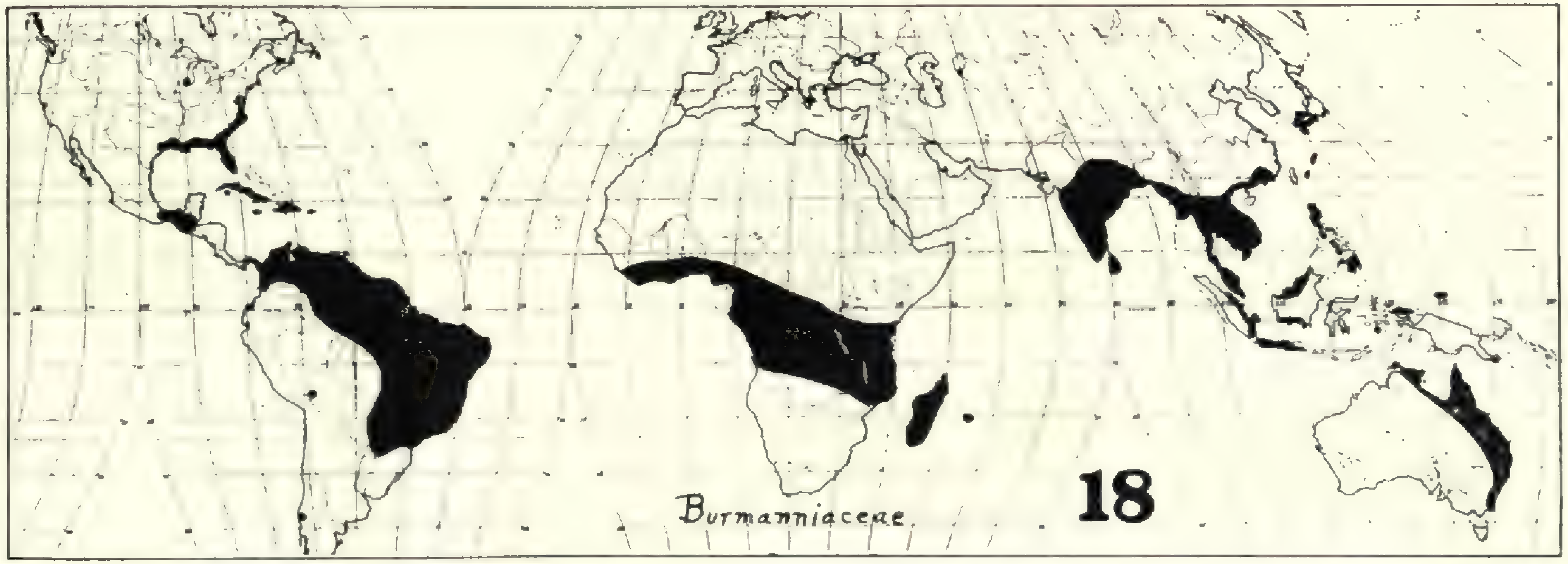
A few species in eastern North America have today ranges quite comparable, except for minor details, with that of *Schizaea pusilla*, admittedly a relic from the boreal Cretaceous or earlier dispersal of its progenitors. This parallelism of range (on some of the Appalachian plateaus, uplifted from their sea-level position of the Cretaceous, and on the Atlantic Coastal Plain or its margin, with few if any intermediate stations) is well shown by one of the most distinct and rarest of pondweeds, *Potamogeton confervoides* Reichenb. (PLATE 204; also MAP 33). This remarkable species has the free ligules and continuous spike of the comparatively advanced subgenus *Eupotamogeton;* it constitutes Hagström's subsection *Monticoli* of *Eupotamogeton*, but, as he has stated, it exhibits such primitive anatomical characters as to form a "transition to the [primitive] *Coleogeton* species";[3] and in its delicate foliage, its branching, its creeping rhizome with subterranean tubers, and its long, terminal peduncle it so strongly simulates *P. pectinatus* L. (PLATE 204), *P. filiformis* Pers. and other species of the most primitive subgenus *Coleogeton* that only by the closest examin-

[1] Berry, l. c. 244.

[2] Seward, Journ. Royal Hort. Soc. l. pt. 1: 17 (1925).

[3] Hagström, *Critical Researches on the Potamogetons*, Kungl, Svenska Vetenskapsakad. Handl. lv, No. 5: 86 (1916).





Map 17, Geographic Range of Lycopodium carolinianum and Allies; 18, of the Burmanniaceae.

ation can it be distinguished from them. It certainly is not a mere accident that today the obvious relic-species, *Schizaea pusilla,* on the uplifted Cretaceous peneplain of Newfoundland (and apparently also of Cape Breton) should there border the shallow pools in which the rare and demonstrably primitive *Potamogeton confervoides* is found; nor that these two, along with the equally rare and ancient *Lycopodium carolinianum* L., should be close neighbors in that haven of relic-species, the Pine Barrens of New Jersey, for, surely, the amazingly disrupted austral occurrence (map 17)[1] of restricted colonies of *L. carolinianum* and its immediate allies[2] is good evidence, if evidence were needed, that that species (in the broad sense) is of great antiquity. It is also not a mere accident that except for rare stations in the silicious Coastal area, *P. confervoides* should be known in Pennsylvania, New York and New England only in pools on or among the highest mountains ("Alleghany Mountains," sent by Schweinitz to Reichenbach; Pocono Plateau, Pennsylvania, where associated with the relic colonies of Coastal Plain types enumerated on p. 39; Adirondack Mts., New York; Taconic and Green Mts., Massachusetts and Vermont; White Mts., New Hampshire; Mt. Katahdin, Maine).

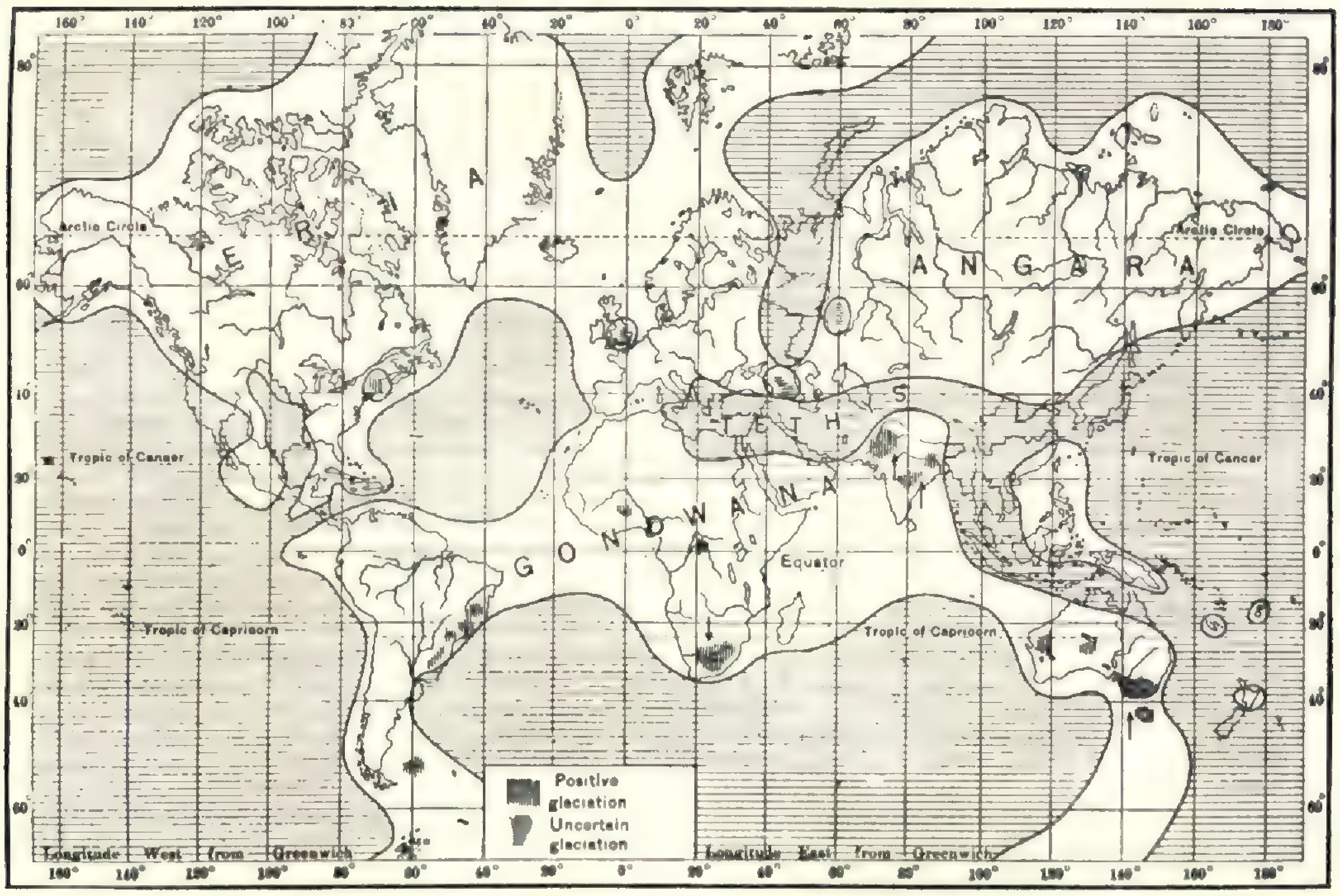
The present-day ranges of the tropical groups which are represented in temperate eastern North America closely coincide with the existing continental and insular remnants of hypothetical Gondwana, the great equatorial land which, in the Permian, is supposed by some to have stretched from Australia and peninsular India to Africa and South America. But those who have reconstructed Gondwana Land (map 19)[3] tell us that, in Lower Cretaceous time Gondwana had become much disrupted and that by mid-Cretaceous (map 20) it had broken into remote Australia, Lemuria, Ethiopia, and Amazonia. Furthermore, during the supposed existence of Gondwana that equatorial land has been pictured as having had no direct connection with the Atlantic United States, and subsequently (maps 22–27)[4] the gap between the southeastern United States and Brazil is said to have been

[1] Doubtless a few tropical and austral stations have been overlooked, since most "Floras" omit the Pteridophyta.

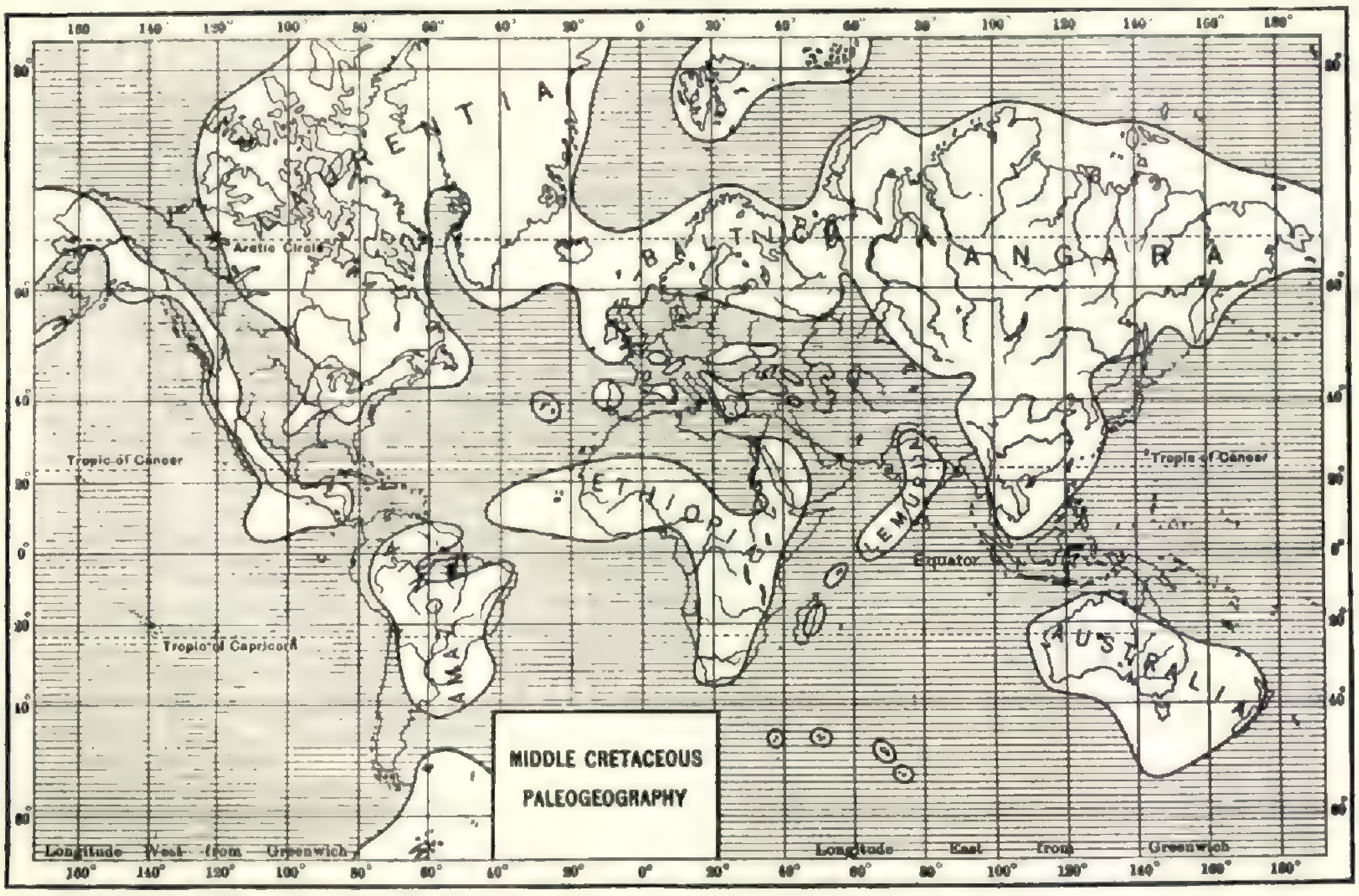
[2] Including *L. drepanoides* Blume, *L. Drummondii* Spring, *L. goyozense* and *L. meridionale* Underw. & Lloyd, *L. paradoxum* Spring, *L. sarcocaulon* Welw. and *L. tuberosum* A. Br.

[3] Map 19 is copied, with permission, from Schuchert, Hist. Geol. fig. 434 (New York. John Wiley & Sons, Inc.); map 20 from Schuchert's fig. 488.

[4] Maps 22–27 are from Schuchert, *Geological History of the Antillean Region,* Bull. Geol Soc. Am. xl. 337–360 (1929).

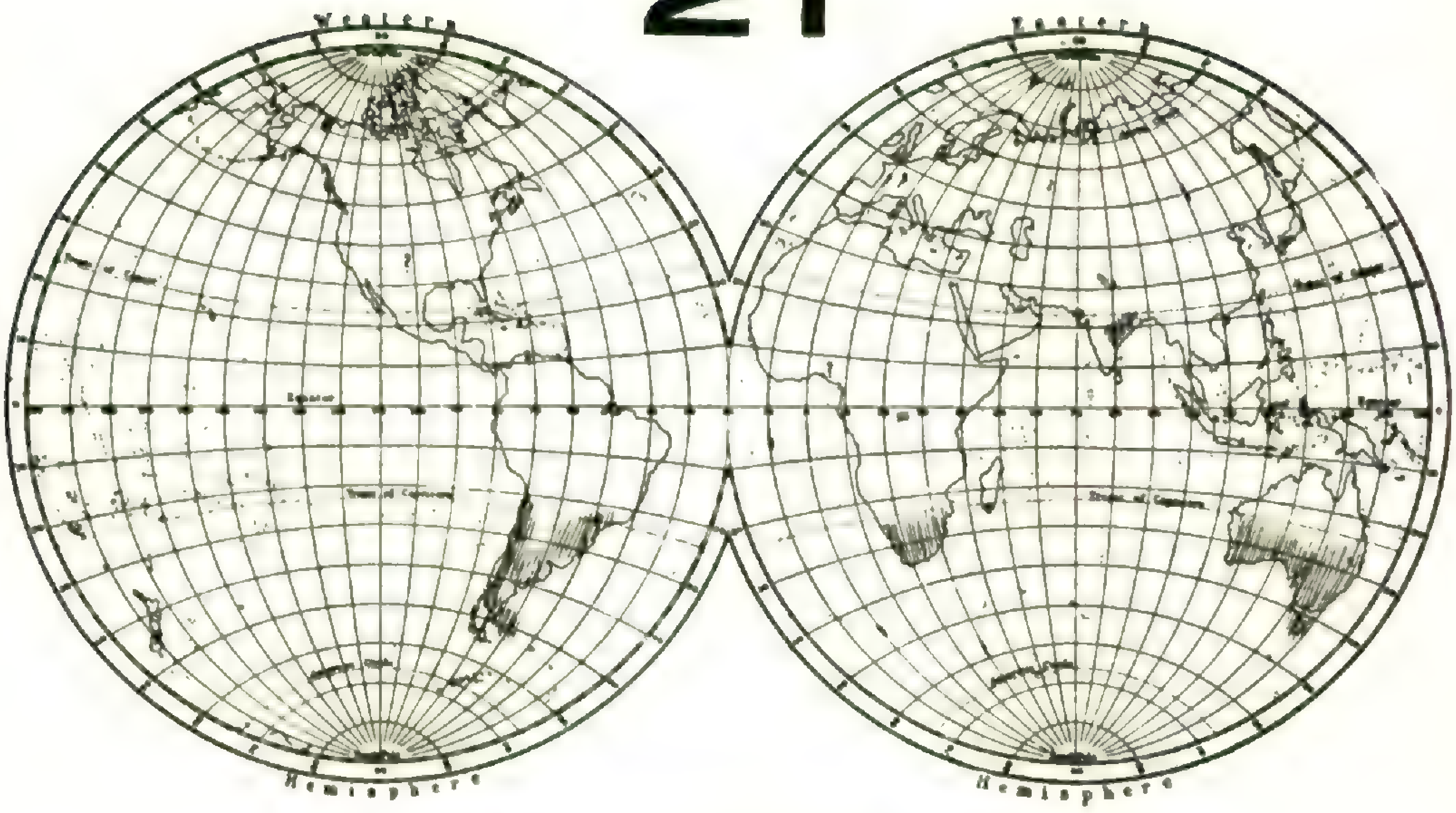


Map 19, the World in Permian time (after *Schuchert*).

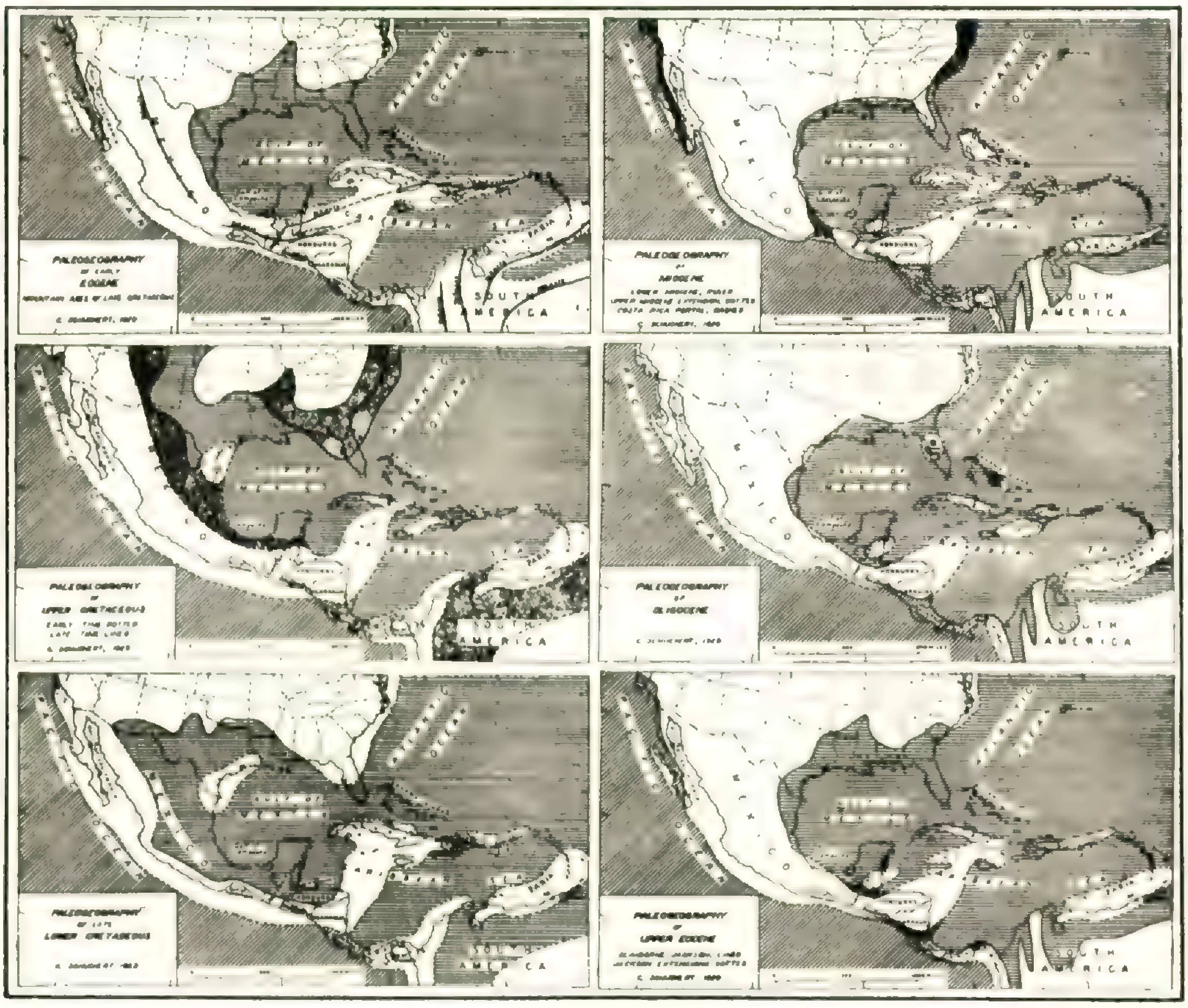


Map 20, the World in Mid-Cretaceous time (after *Schuchert*).

21



Map 21, the Permian Glaciation (after *Coleman*)



Map 22 (lower left), Geographic Connections of the Antilles in the Lower Cretaceous; 23 (middle left), in the Upper Cretaceous; 24 (upper left), in the early Eocene; 25 (lower right), in the Upper Eocene; 26 (middle right), in the Oligocene; 27 (upper right), in the Miocene (all after *Schuchert*).

continuously maintained and often broadened. Consequently, Gondwana, as usually defined and whether a hypothetical or a demonstrated Permian land, need not necessarily concern our immediate problem. If, however, with Alphonse De Candolle and many other thoughtful students, we conceive the angiospermous groups of today as having lived in Jurassic time[1] or if, with Velenovský, Mrs. Arber[2] and numerous others, we push the ancestral Angiosperms (the Protangiosperms of Engler[3]) back beyond the Cretaceous, and also greatly extend the area of Gondwana in the Western Hemisphere to reach the southeastern United States, then that hypothetical equatorial land will immediately come into the picture. In this connection it is worth noting that my associate, Dr. Hugh M. Raup, calls attention to the very striking fact, that hundreds of tropical and austral groups of today have restricted ranges almost coincident with the known areas of Permian or Permo-Carboniferous glaciation (see MAPS 21 and 19; also MAPS 9–18). If, indeed, Angiosperms existed at that time and if youthful and aggressive groups then spread into newly available territory as do virile and dominating groups today, it would seem only natural that, with the decay of the Permian glaciers, the most aggressive plants of the adjacent territory should quickly have taken possession and that their descendents should still linger about their ancestral centers. By some the herbaceous habit is associated with cold climates, and many herbs (as well as shrubs and trees) undoubtedly originated during the Pleistocene, while many others seem to be even more youthful; but, surely, many of the herbaceous species of today are as ancient as their living ligneous associates. And it is certainly significant that the greatest glaciation in the history of the world was the Permo-Carboniferous (MAP 21).[4] If it be true that the development of herbs has been largely a response to refrigerating climates, it must be apparent that, given the progenitor-stocks, herbs would had a phenomenal epoch of development during the Permo-Carboniferous glaciation.

[1] "De nos jours, les Smilacées sont mêlées aux Cycadées dans l'Afrique australe, la Nouvelle-Hollande et l'Inde. Existaient-elles déjà dans l'hémisphère austral, au Japon, au Mexique, etc., quand les terrains jurassiques se formaient en Europe? C'est extrêmement probable; malheureusement on connait peu de fossiles de ces pays lointains, et les géologues ne sont guère en état de certifier ce qui se passait dans une même période d'années à des distances aussi grandes."—A. DC. Mon. Phan. i. 35 (1878).

[2] For summary of literature and pertinent discussion see Arber, Agnes, *The Tree Habit in Angiosperms: its Origin and Meaning*, New Phyt. xxvii. 71–84 (1929).

[3] Engler, Natürl. Pflanzenf. ed 2, xiv^{a}. 138–145 (1926).

[4] Map 21 reproduced, with permission, from p. 91 of Coleman, Ice Ages Recent and Ancient (New York. Macmillan).

Gondwana was, after all, only a hypothetical land. Originally reconstructed and subsequently greatly extended to account for the disrupted localities of now fossil species, it furnishes a sort of explanation of early tropical dispersal. But, at this very day, hundreds of living groups of Angiosperms (as well as many groups of Pteridophytes) have a "Gondwana" or relic pantropical range. Nevertheless, there is now no circum-tropical connection, such as is generally assumed for Permian time, between these areas of living plants; consequently, the hypothetical status of Gondwana becomes strikingly accentuated.

Leaving these purely theoretical realms and returning to better demonstrated and, consequently, firmer geological and paleontological grounds, we are at least justified in looking upon the present Atlantic North American representatives of prevailingly tropical groups as lineal descendents of plants which reached eastern North America out of the North at a time, during the Mesozoic and perhaps early Cenozoic, when the ancient rock-floor which now constitutes the Appalachian Upland was peneplained or near sea-level. With the Cretaceous seas (see MAP 20) occupying the north-and-south center of the present continent and its southern and southeastern margin and the Tertiary seas later invading much of the southern and eastern portion of the same area, the only section of present eastern continental North America then continuously accessible to these plants was the ancient baseleveled Appalachian region with the Laurentian shield to the north and northwest.[1] Then, as the later uplifting of the once peneplained Appalachian region progressed, making halts at intervals through Tertiary time, with the consequent deep dissection of the extensive plateau and its inevitable conversion from a low Cretaceous plain with retarded drainage into a vast upland mesophytic area, ready for occupation by the abundant mesophytic types of the climax forest which could now freely mingle between Asia, northwestern America, eastern North America and Europe, the members of the tropical and subtropical groups (and with them many endemic groups) represented in eastern North America were largely forced (by drainage of the area and by invasion by the hoard of actively colonizing mesophytic types) to abandon their once congenial but now un-

[1] In this connection, the absence from Pacific North America of the hundreds of tropical and subtropical groups which linger on the Atlantic Coastal Plain is significant; during the Cretaceous eastern and western North America were completely isolated from each other (see MAP 20).

congenial haunts on the Appalachian area and to move out to the newly available xerophytic and hydrophytic habitats, chiefly on the Coastal Plain (though in some instances west and northwest of the Appalachian axis), where the acid savannahs, bogs, shallow pools and dry sands supply the ecological conditions in which these descendents of Cretaceous and early Tertiary hydrophytes and xerophytes can still survive.

In 1897, Dr. T. H. Kearney, directing attention to "*The Pine-barren Flora in the East Tennessee Mountains*,"[1] said: "One would hardly expect to find a large proportion of this flat country flora hidden among the high ridges of the Alleghanies; yet this is unmistakably the case. Especially along the picturesque French Broad river, . . . there is a notable incursion of plants usually considered typical of the coastal plain," and, after enumerating several such species, Kearney continued: "What are we to infer from the presence of these austro-riparian plants among the flora of northern origin that chiefly covers these mountains? Possibly they are the advance-guard of an invading army. Much more probably, however, they are the lingering survivals of a more southern flora, once widely distributed over the southern Appalachian region." Three years later, developing the subject more fully and interpreting the migration to the Coastal Plain as a response to Pleistocene cold, Kearney[2] suggested that "it may be conceived that while some individuals of each hypothetical Pliocene ancestral species maintained themselves in well-sheltered situations and were not forced [by Pleistocene cold] to a change of abode,[3] others escaped the changing environment by a gradual retreat into the warmer lowlands. The individuals which remained in the mountains were the direct ancestors of the present Appalachian species; while those which migrated and later accustomed themselves

[1] Kearney, Plant World, i. 33–35 (1897).

[2] Kearney, *The Lower Austral Element in the Flora of the Southern Appalachian Region*, Science, ser. 2, xii. 830–842 (1900), especially p. 839.

[3] The effect upon vegetation of ice-sheets hundreds of miles away was probably not so great as was formerly supposed. Witness the occurrence today of splendid forests *on* the glaciers of Alaska; and the occurrence at the ice-free margin of otherwise ice-capped Greenland of such plants of sea-level in the eastern United States as *Woodsia ilvensis, Cystopteris fragilis, Equisetum sylvaticum, E. hiemale, Deschampsia flexuosa, Carex brunnescens, Streptopus amplexifolius, Corallorrhiza trifida, Stellaria borealis, Ranunculus Cymbalaria, R. reptans, Coptis groenlandica, Potentilla palustris, Viola Selkirkii, Epilobium angustifolium, Cornus canadensis, Pyrola secunda, Andromeda glaucophylla, Vaccinium Oxycoccus, Menyanthes trifoliata, Utricularia intermedia* and *Linnaea borealis*, var. *americana;* or the occurrence on tablelands of Newfoundland or Gaspé of members of chiefly tropical groups almost side-by-side with typical plants of Ellesmereland and Melville Island.

in the Coastal Plain . . . gave rise to the Austro-riparian species that attract our attention today because of their close resemblance to Appalachian forms." In 1904 the late Professor Harshberger[1] suggested a similar derivation of some of the endemic North American plants of the Coastal Plain from the crests of the Alleghenies. Somewhat later, Dr. Witmer Stone stated that "The flora at the top of Meadow Mountain, the summit of the Alleghenies [in Garrett County, Maryland], . . . was very much as in the pine barrens of New Jersey, and is quite likely a remnant of an early primitive flora such as we have there."[2] In 1924 Dr. John K. Small expressed the same view. The relic-genus *Narthecium* (or *Abama*) has one wide-ranging species in Europe, one or two highly localized species in the eastern Mediterranean region, one in Japan, one in California and Oregon; and it has long been of great local interest in eastern America through *N. americanum* Ker., a famously rare plant of the very heart of the New Jersey Pine Barrens. But in 1919 a species closely related to *N. americanum* was discovered at a single station in the mountains of North Carolina. In describing the mountain plant as *Abama montana*, Small said: "It is not surprising that a bog-asphodel should come to light in the mountains of North Carolina, as several kinds of plants otherwise known only in the pine-barrens of the middle Atlantic Coastal Plain also grow in the Appalachians. . . . It is scarce, evidently rare, and may be on the verge of extinction. It may be that in this species we have one of the progenitors of the *Abama* of the Coastal Plain, for the high mountain region was the reservoir whence many of our Coastal Plain plants were derived."[3]

The derivation of much of the flora of the youthful Coastal Plain of the United States from the ancient Appalachian Upland, which in the Cretaceous itself had a coastal-plain status, is strongly supported by the very striking condition in the Antillean and Mexican regions. As shown by Schuchert[4] (maps 22–27), portions of the Greater Antilles (Cuba, Haiti, Jamaica, Porto Rico, etc.) have been in continuous existence at least since the Lower Cretaceous and much of the time connected with the Central American and Mexican tablelands; but the Bahama Islands did not rise above the sea until the Miocene,

[1] Harshberger, Proc. Acad. Nat. Sci. Phila. 1904: 607.

[2] Stone, as reported in Bartonia, No. 5: 16 (1912).

[3] Small, Torreya, xxiv. 86 (1924).

[4] Schuchert, *Geological History of the Antillean Region*, Bull. Geol. Soc. Am. xl. 337–360 (1929), from which my maps 22–27 are photographed.

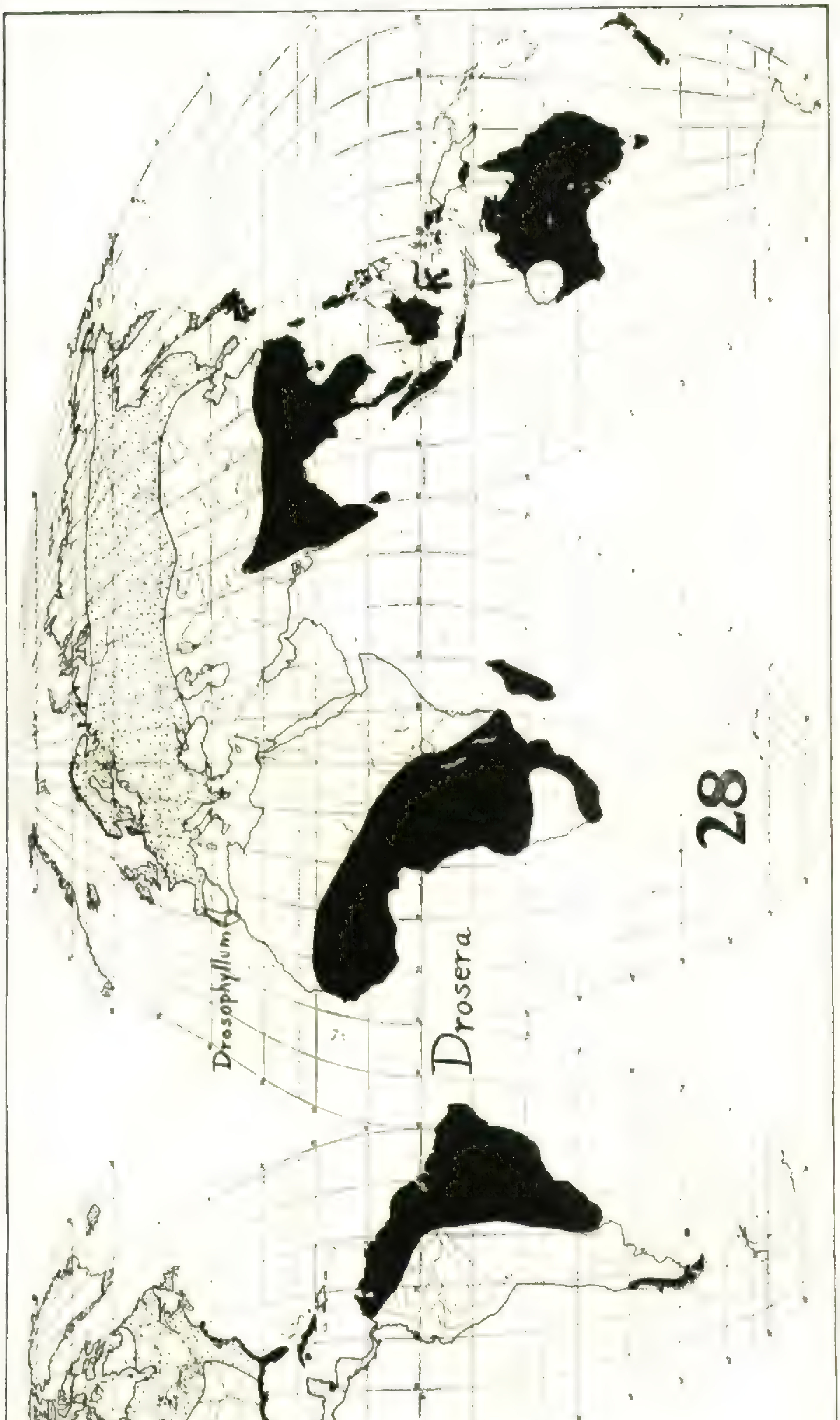
while all but the base of the Peninsula of Yucatan is even younger. It is, therefore, significant, when we check the living floras of the Bahamas[1] and of Yucatan,[2] to find that on these very youthful areas, which are far isolated from more ancient upland centers, there are no species of *Schizaea* (MAP 9), the *Haemadoraceae* (MAP 10), the *Xyridaceae* (MAP 12) and *Lycopodiaceae* (see MAP 17); but that on the older Greater Antilles and the old Mexican or Central American Plateaus or their margins these groups of the young Coastal Plain of the United States are all represented. Ancient *Diospyros* (MAP 14), also, is on the Greater Antilles but, although locally present in Yucatan, it is absent, as a native, from the Bahamas. Many other tropical or austral groups which today have a northern remnant persisting on the young Atlantic Coastal Plain of the United States and on the ancient Greater Antilles and the equally ancient Mexican or Central American Plateaus or at their margins, are absent, likewise, from the young Bahamas and from still younger Yucatan (except occasionally as cultivated species or as relics of cultivation): such groups as the *Eriocaulaceae*, in Mexico up to 3355 m. (11,000 ft.), the *Marantaceae*, up to 915 m. (3000 ft.), the *Burmanniaceae* (MAP 18), up to 1675 m. (5500 ft.), *Boehmeria*, up to 1585 m. (5200 ft.), *Clitoria*, up to 2135 m. (7000 ft.), *Rotala*, up to 1525 m. (5000 ft.), *Myriophyllum* § *Tessaronia*, up to 1740 m. (5700 ft.) and *Dyschoriste*, up to 2400 m. (8000 ft.); while *Psilocarya* occurs on the Greater Antilles but not in Mexico and *Litsea* in Mexico ascends to 3050 m. (10,000 ft.). Similarly, on the Mexican Plateau we find representatives of *Xyris* at 1830 m. (6000 ft.) and of *Schizaea* at 1200 m. (3925 ft.).

The always interesting genus *Drosera* (MAP 28),[3] with three circumboreal species and another (*D. linearis* Goldie) confined to boreal America, has most of its living species concentrated in the Southern Hemisphere and in southern Asia, with a few related species on the Greater Antilles, on the Coastal Plain of the United States and in Central America; but the genus is unknown from either Yucatan or the Bahamas. The unique *D. filiformis* Raf., however, differs from all other American species in its hardened bulbiform woolly base, its linear-filiform and very prolonged (up to 6 dm.) leaves without elon-

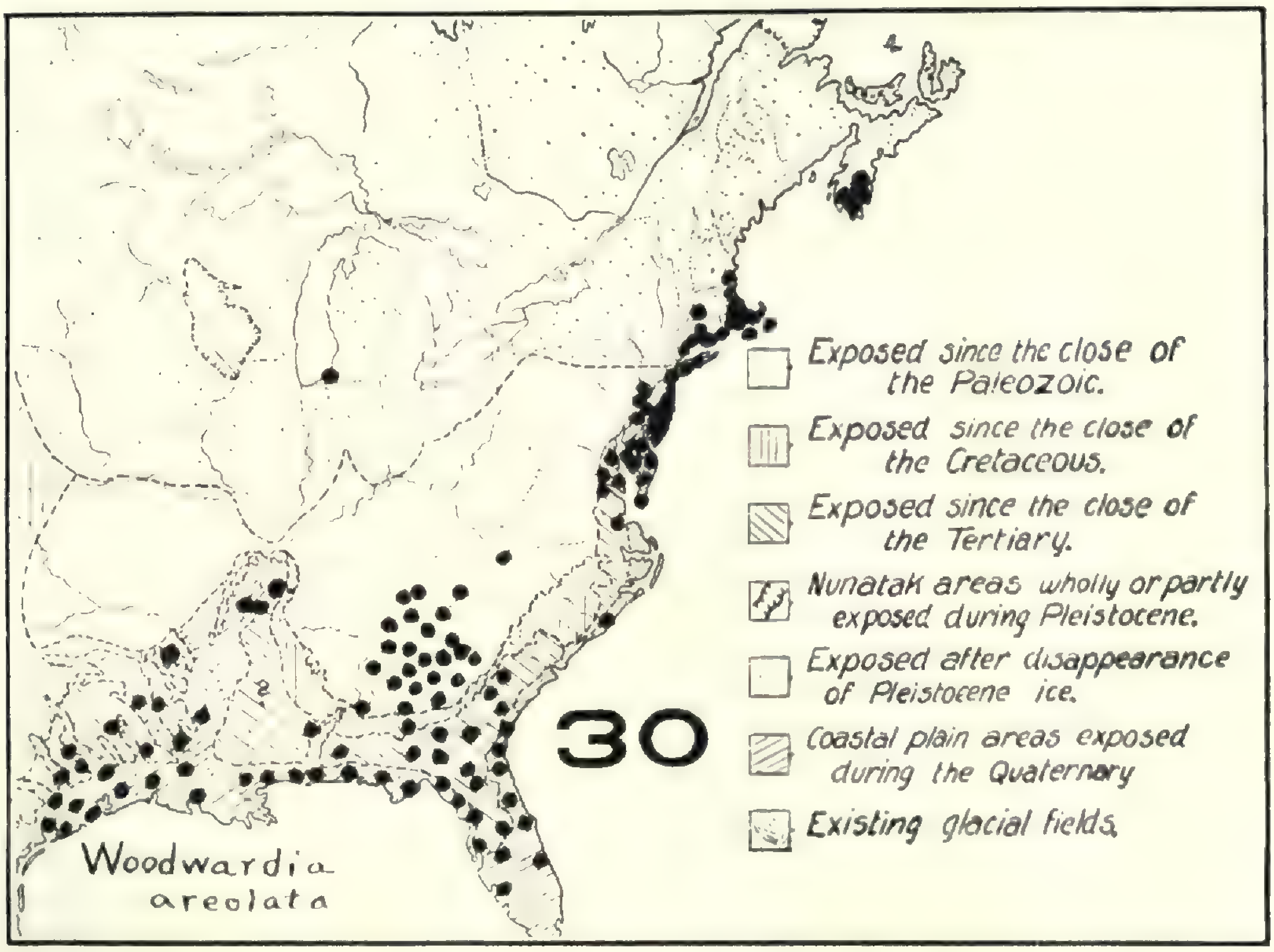
[1] See Britton & Millspaugh, The Bahama Flora (1920).

[2] See Standley, *Flora of Yucatan*, Field Mus. Publ. 279—Bot. Ser. iii. no. 3 (1930), which has come to hand while this paper is going to press.

[3] The map is largely copied from that of Diels in Engler, Pflanzenr. iv [112], supplemented by material in the Gray Herbarium. The North American range is altered to accord with the specimens and citations covering this area.



Map 28, Geographic Range of Drosera, the boreal Species indicated by Stippling, and of Drosophyllum (in ellipse).



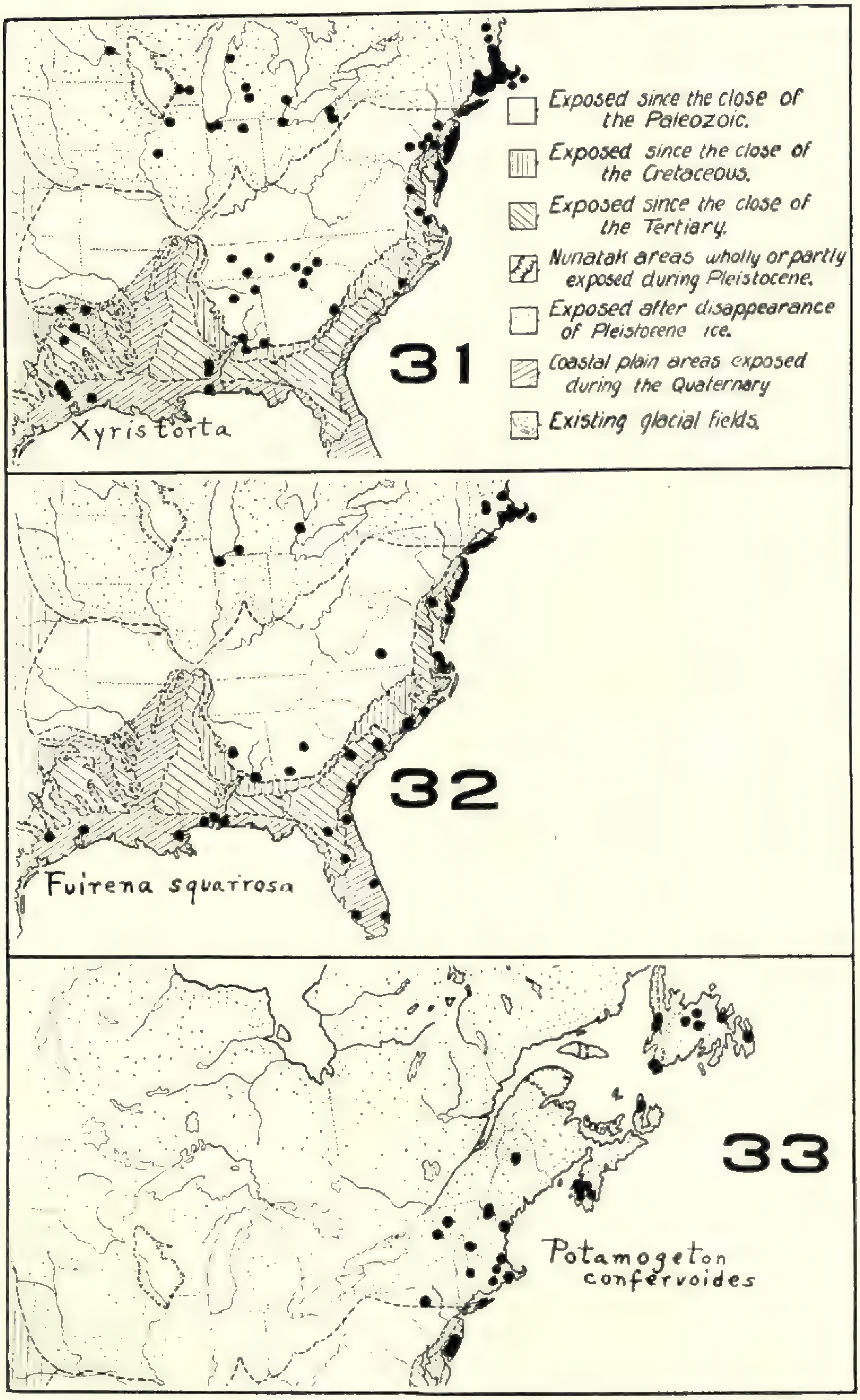
Map 29, Geographic Range of DROSERA FILIFORMIS (upper and lower black areas) and of DIONAEA (middle black area); 30, of WOODWARDIA AREOLATA (an additional station should be recorded, at the southwestern end of Lake Erie).

gate petiole, its large purple petals and its seeds; it is far more closely related to some of the Indian, Malayan and Australian species than to any of the broad-leaved, long-petioled and white-flowered species (of § *Rossolis*) with which it grows. It is restricted to two wholly disrupted areas of the Coastal Plain (see MAP 29) and its present distribution is best explained as a result of migration in two directions off the now uplifted Appalachian Upland. Outside the now essentially austral and tropical genus *Drosera* the family has two monotypes: *Drosophyllum lusitanicum* L. (see MAP 28) of the ancient Iberian Tableland and adjacent Morocco and *Dionaea muscipula* Ellis (see MAP 29) of the Cretaceous (hardly Tertiary or Quaternary) Coastal Plain of the Carolinas.[1] The antiquity of the insectivorous *Droseraceae*, therefore, can scarcely be doubted.

Not only, as we have seen, do the tropical groups represented on the Atlantic Coastal Plain of the United States have representatives on the high tablelands of the Appalachian Mountains, on the older of the Antilles and on the high plateaus of Mexico or of Central America; they are also well represented at low levels west and northwest of the Appalachian axis, particularly in the upper Mississippi Valley, and about the Great Lakes where the sands and peats of Pleistocene or later origin offer them peculiarly attractive habitats. Their migration out from the now elevated Appalachian area to the Coastal Plain on one side, to the region of the Great Lakes on the other, is clearly indicated by *Woodwardia areolata* (L.) Moore (MAP 30), a characteristic fern of the Coastal Plain but also found on the tablelands of the southern Appalachians at 3000 ft. (915 m.), and otherwise known only in northwestern Ohio and in southwestern Michigan.

This movement out from the Appalachian center is even better displayed by the very distinct, bulbous *Xyris torta* Sm. (MAP 31), a common species of the Coastal Plain sands, also at 2000–4000 ft. (610–1220 m.) on the high silicious tablelands from North Carolina and Tennessee southward, and with a rather extensive area about the Great Lakes. In these cases (and scores of others which might be cited) migration from the ancient Appalachian region is a reasonable explanation of the present segregations. In some other cases we do not now (or yet) know any existing stations high on the Appalachians but it is fair to assume that during the baseleveled Cretaceous stage of this area they must have there existed; and it is reasonable to be-

[1] For all known stations see Coker, *The Distribution of Venus's Fly Trap* (*Dionaea muscipula*), Journ. Elisha Mitchell Sci. Soc. xliii. 221 (1928).



Map 31, Geographic Range of Xyris torta; 32, of Fuirena squarrosa; 33, of Potamogeton confervoides.

lieve that, to the already surprisingly large number of relic-colonies of tropical types known on the mountains of the Carolinas and Tennessee, stations of members of these other groups may soon be added. *Potamogeton*, sub § *Javanici* (map 13), not yet known either on the Appalachian Upland or on the true Coastal Plain, is decidedly an exception. Much more typical is *Fuirena squarrosa* Michx. (map 32), characteristic of Coastal Plain sands, with a slight overlap on the ancient Piedmont area, but unknown from the high tablelands, and isolated on the sands of southern Michigan and northern Indiana. The *Burmanniaceae* (map 18) yield an even more striking instance. The family is widespread in tropical and subtropical regions but, like many other groups, it has a slight extension northward in eastern Asia and another around the Gulf and Atlantic Coastal Plains of the United States. North of Virginia the family is unknown, save for the extraordinary little species of prairies at Chicago, *Thismia americana* N. E. Pfeiffer.[1] This, as noteworthy a plant as is known in the Great Lake area, is the more remarkable since it belongs to a small subfamily otherwise confined to the Tropics, chiefly of the Old World.

The cases I have presented are merely a few illustrations but, without further enumeration or further analysis, enough have been presented to make it clear that, to a large extent the tropical groups which today have a representation on the Atlantic Coastal Plain of the United States or about the Great Lakes are also found persisting (often as rare relics) on the high tablelands of the Mexican Plateau as well as on the tablelands of the Appalachian Mountains or at other spots back of and older than the outer Coastal Plain. I am aware that, in looking upon the members of these and other primitive groups which now occur upon or among the mountains of north-eastern Pennsylvania, northern New York and western and northern New England as preglacial relics there, I am not in full accord with orthodox Pleistocene geology, which asks us to believe that the late ice-sheets so vigorously overrode these mountains as to denude them of all life. The parallelism is so definite, however, between these Coastal Plain species having representatives on the elevated tablelands of the more southern and quite unglaciated Appalachians, as well as on the Central American, Mexican and Antillean tablelands, and their occurrence on the supposedly denuded mountains farther north, that the botanist, at least, is forced to believe that the Pleistocene de-

[1] Pfeiffer, *Morphology of Thismia americana*, Bot. Gaz. lvii. 122–134 (1914).

struction of plants on the high mountains of New England, New York and northeastern Pennsylvania has been vastly overestimated. It is far more logical to look upon the very primitive *Potamogeton confervoides* (MAP 33), an aquatic with plump fruits not adapted for flying, as a preglacial relic on the high mountains of northern and western New England, on the Adirondacks and on the Pocono Plateau (as well as on the unglaciated or but slightly glaciated tablelands of Newfoundland and of Cape Breton), than to picture it as making a post-Wisconsin leap from the coastal pools to the highest mountain-masses far to the northwest and north and successfully finding welcoming pools on them all, but not landing in the thousands of intermediate lowland ponds. *P. confervoides,* one of the most primitive members of the worldwide subgenus *Eupotamogeton,* is so rare that only a few botanists have ever seen it growing. If any lowland pondweed were in post-Wisconsin time to do the improbable and invade the elevated mountain-pools from sea-level, it would less unreasonably be a common or, in the region, essentially ubiquitous and less primitive species (also of peaty depressions and pools), such as *P. pusillus* L., *P. Spirillus* Tuckerm., *P. epihydrus* Raf.[1] and *P. gramineus* L.; but these almost weed-like species of all pools at low levels, north, south, east and west, have not invaded the mountain-ponds of New England, New York and Pennsylvania, where the primitive and excessively rare Coastal Plain *P. confervoides* and its Coastal Plain congener, *P. Oakesianus* Robbins, alone represent the genus. Near the White Mountain stations of *P. confervoides* occur two endemic alpine xerophytes: *Potentilla Robbinsiana* Oakes, nearest related to the Siberian *P. elegans* C. & S.; and *Geum Peckii* Pursh, the isolated representative of *G. calthifolium* Mertens of the North Pacific and Bering Sea region. Obviously these two endemic neighbors of the Coastal Plain *Potamogeton confervoides* on the White Mountains have not originated there in post-Wisconsin time.

If this general reasoning is correct, that the Coastal Plain plants of the eastern United States before occupying the youthful Coastal Plain had had direct progenitors on the Cretaceous peneplain which, through Tertiary uplifts, has again become the Appalachian Moun-

[1] Although not found in the high subalpine ponds of New England and New York, *Potamogeton epihydrus* is, surely, to be sought there. On the great tableland of the Table-top Range in Gaspé, which Coleman and Alcock independently conclude "escaped the erosion of the continental ice sheets," it occurs in the pools along with *Myriophyllum Farwellii* Morong, the most northern representative of the tropical and Coastal Plain *Myriophyllum* § *Tessaronia.*

tains, it follows that these Coastal Plain groups are of as ancient ancestry as any angiosperms now living in eastern North America. It is, therefore, particularly noteworthy that in world-wide groups their representatives are invariably regarded by monographers as wholly differentiated specifically from their relatives now living in Africa, tropical India and Australia.

When we turn northward to the physiographically very youthful soils (or lack of soils) which have resulted from the Pleistocene glaciation, much of the vast area of eastern Canada and the northernmost States, a region in which the plant-population is, in some places, just moving in to occupy the newly available territory, we find a great assemblage of dominantly boreal (or extreme austral) genera: *Sparganium, Festuca, Glyceria, Agropyron, Calamagrostis, Eriophorum, Carex, Juncus, Salix, Alnus, Betula, Sorbus, Rubus, Fragaria, Potentilla, Rosa, Lathyrus, Epilobium, Pyrola* and hundreds of others. Although many stable species in this flora, like *Sparganium minimum* Fries, *Potamogeton filiformis* Pers., *P. obtusifolius* Mert. & Koch, *P. praelongus* Wulfen, *Triglochin palustris* L. and *maritima* L., *Cinna latifolia* (Trev.) Griseb., *Eriophorum gracile* Koch, *Caltha palustris* L., *Pyrola minor* L. and *Lysimachia thyrsiflora* L., are regularly regarded as identical with plants of Eurasia, others, like *Scheuchzeria palustris* L.[1] and *Menyanthes trifoliata* L.,[2] in eastern America are sufficiently different from the Eurasian plants in size of flower or fruit as to receive varietal designations; but no one has seriously proposed to treat them as different species. And when we get into heteromorphic tangles like *Festuca rubra*, the *Poa pratensis* jumble, *Agropyron repens*, *Calamagrostis canadensis* (including *Langsdorfi*), the *Carex vesicaria* morass, *Juncus effusus*, the *Salix glauca* complex, *Alnus incana*, the *Betula alba* forest, *Cerastium arvense*, *Sorbus*, *Rubus idaeus*, and a full hundred other always perplexing mazes, common experience on both sides of the Atlantic is sufficient to indicate the utter lack in these groups of the clear specific differentiations which every systematist looks for but in these plants fails to find.

The key-note in this youthful flora of the vast Canadian region, mostly available for plant-occupation only during the last few thousand years, is, then, the essential lack of fundamental specific segregation from the European representatives of these plants. This is in marked contrast with the condition shown in the amphigean

[1] See Fernald, Rhodora, xxv. 178 (1923).
[2] See Fernald, Rhodora, xxxi 195 (1929).

genera now characteristic of the ancient Appalachian Upland and with the sharp specific differentiation of the Coastal Plain species from their allies in Africa, tropical Asia and Australia. Whether we derive the disrupted colonies of the tropical groups out of the wide-spread boreal flora of the Cretaceous and early Tertiary, which seems to me the logical deduction, or whether we prefer to picture them as having spread across a hypothetical trans-Atlantic land, it is clear that long after the tropical floras had become geographically separated the northern lands still maintained a broad connection. Many geologists have postulated a late Tertiary and Pleistocene uplift of the Arctic lands. Thus, Mecking,[1] following Suess, says of the Arctic: "At the end of the Tertiary began an uplift which continued into the Glacial Period. At the climax of the latter there followed a general sinking, which, by filling the valleys and troughs, created the sounds and then gave way to a newer uplift which still continues"; and Simmons, summarizing the various studies of former continuity of Arctic lands, concludes: "That the northern parts [of North America] . . . were lifted considerably above their previous level, cannot be doubted . . . most authors are inclined to refer the beginning of the rise . . . to the last part of the tertiary era."[2] The amount of this late Tertiary and early Pleistocene uplift has generally been estimated at 2000–3000 feet (600–900 meters); and study of Dr. Nansen's bathymetric map[3] of the Arctic Basin shows that an elevation of 2000 feet (600 meters) would today unite northwestern America and Asia and would connect northeastern America by two routes with Greenland, thence via Iceland with Scotland and Scandinavia. It is, then, quite clear that in late Tertiary, and probably in early Pleistocene time, the northern plants had essentially free routes for interchange between Eurasia and North America. Consequently, sharp specific differentiation in the comparatively youthful plants of amphigean relationship which are chiefly restricted to recently glaciated northern Europe and recently glaciated northern America is the exception rather than the rule.

Time does not permit my now specially discussing the outstanding

[1] Mecking, *The Polar Regions: a Regional Geography*, Geogr. Polar Reg., Am. Geogr. Soc., Sp. Pub. no. 8: 220 (1928).

[2] Simmons, *A Survey of the Phytogeography of the Arctic American Archipelago*, Lunds Univ. Årsskrift. n. f. Afd. 2, Bd. 9, Nr. 19: 152 (1913).

[3] Bathymetric Map of the Arctic Basin in Nansen, *The Oceanographic Problems of the still unknown Arctic Regions*, in Problems of Polar Research, Am. Geogr. Soc., Sp. Publ. no. 7, t. 1 (1928).

features of certain other floras in eastern America, like the high degree of relic-endemism on the nunatak areas, a topic already discussed by me in other papers[1] (190 rare and localized endemics already known, and 160 others with relic-colonies isolated by 1500–4500 miles from other colonies of the species), or the multiplicity of intergradient forms[2] of *Panicum, Salix, Amelanchier, Crataegus, Rubus, Vaccinium* (§ *Cyanococcus*) and *Aster* and the dominance of more than 1000 aggressive species introduced from Europe during the last three centuries on the clearings made by the white man, the youngest spots of all. From what I have been able to present, however, certain deductions, by way of summary, seem justified:

1. The characteristic flora of the present southern Appalachian Upland, made up largely of groups which were cosmopolitan in the Mesozoic or early Cenozoic but now reduced to geographically segregated remnants in the Northern Hemisphere, is obviously ancient and its species are usually (but not always) clearly differentiated from those of the same genera in eastern and central Asia or in southeastern Europe.

2. The Coastal Plain flora of Atlantic North America is distinguished by the abundance of tropical groups represented. Although these plants now chiefly occupy open silicious, peaty and aquatic habitats in comparatively youthful regions of eastern North America, it is probable that they or their progenitors formerly existed on the area of the ancient Appalachian Upland, especially in the Cretaceous, when that primitive region of the continent was baseleveled and reduced essentially to sea-level and at the time when the tropical groups of today were widespread in the North. Then, with the Tertiary uplift of the Appalachian region and its final conversion into a vast well-drained mesophytic area available to the groups which now constitute the climax forests of the Appalachian Upland, the Cretaceous xerophytes and hydrophytes which had previously occupied the ground gradually moved out to the newly available and for them more congenial Coastal Plain and similar habitats to the west and northwest. These species of the Coastal Plain, whose direct progenitors were probably segregated geographically from their

[1] For discussion see Fernald, *Isolation and Endemism in Northeastern America*, Am. Journ. Bot. xi. 564 (1924); *Persistence of Plants in Unglaciated Areas of Boreal America*, Mem. Am. Acad. xv. 242–244 (1925); *Some Relationships of the Floras of the Northern Hemisphere*, Proc. Internat. Congr. Pl. Sci. ii. 1493, 1494 (1929).

[2] For discussion see Fernald, *The Antiquity and Dispersal of Vascular Plants*, Quart. Rev. Biol. i. 236–238 (1926).

African, Indian and Australian allies during the Cretaceous or the early Tertiary, are thoroughly differentiated from the Old World species.

3. The nunatak areas, the scattered unglaciated or only slightly glaciated spots within the region of more widespread glaciation, are distinguished by a high degree of relic-endemism.

4. The dominant groups of the region of northeastern America only lately freed from Pleistocene ice are largely those of recently glaciated northern Europe. These northern lands have been so recently segregated geographically that until geologically recent time there has been free interchange in the floras; and in the ecologically youthful Canadian and northern European regions identity of species in the amphigean genera is so general as to become the rule.

5. The recently cleared lands, like the recently glaciated areas and the Quaternary sands, are also characterized by a multiplicity of variable and often intricately intergrading and hybridizing forms, as well as by the aggressive dominance of unchanged species introduced within three centuries from the youthful flora of Europe.

Some of the points I have discussed are possibly new, though many of them are familiar and very old-fashioned doctrines; but since familiarity so often breeds contempt and the latest doctrines are so frequently supposed to be the best, it may not be amiss to call attention anew to the overwhelming evidence of the soundness of some of the older deductions.

A White-flowered Form of Aster amethystinus.—Two stations made up of plants transplanted from the type colony of *A. amethystinus* f. *leucerythros*[1] in 1924 and 1925, have several times apparently developed pink-flowered seedlings. This year one of the stations produced a white-flowered seedling.

Aster amethystinus Nutt., f. **leucos**, n. f. ligulis albis.—Massachusetts: Worcester, September 24, 1930, *E. W. Bemis* (type in Gray Herbarium).—Earl W. Bemis, Worcester, Massachusetts.

Carex Bebbii in eastern Massachusetts.—On 15 July 1930 I collected in a meadow in Stoughton, Massachusetts, specimens which have been identified by Prof M. L. Fernald as *Carex Bebbii*

[1] Rhodora **32**: 3. 1930.

Olney. The presence of this sedge in eastern Massachusetts has not generally been recognized, and the species is not listed in the *Flora of the Boston District* published some years since in Rhodora. In the last edition of Gray's Manual it is assigned a range from Newfoundland south to western Massachusetts and New York, and westward. In the second edition of Britton and Brown's Illustrated Flora the range is extended south to New Jersey. Its presence as a scattered plant at other places in the eastern part of Massachusetts is shown by specimens in the herbarium of the New England Botanical Club collected in a swamp at Chilmark, Marthas Vineyard, by Sydney Harris on 29 July 1894, and beside a railroad at West Manchester by F. Tracy Hubbard on 30 June 1911.—S. F. Blake, Bureau of Plant Industry, Washington, D. C.

Volume 33, no. 385, including pages 1 to 24 and one portrait, was issued 2 January, 1931.

Photo. by H. M. Raup.

Potamogeton confervoides (left) and P. pectinatus (right) × ½.

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JOURNAL OF

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EDITORIAL ANNOUNCEMENT

One of the provisions (Art. 36) of the International Rules of Botanical Nomenclature, adopted at Vienna in 1905, reads: "On and after January 1, 1908, the publication of names of new groups will be valid only when they are accompanied by a latin diagnosis." The debate before the adoption of this proposition (Art. 77 of Briquet's *Texte Synoptique* of 1904) was spirited and was participated in by representatives of ten countries: Austria (von Hayek), Belgium (Durand), France (Gillot and Perrot), Germany (Drude, Engler, Fedde, Hallier, Harms and Magnus), Java (Hochreutiner), Russia (Borodin and de Jaczewski), Spain (Návas), Switzerland (Briquet and Wilczek) and the United States (Barnhart, Britton and Robinson). It became quite clear at Vienna, that every one conversant with current activity in taxonomy recognized the tremendous volume of fundamentally important work done by the botanists of Russia, Finland, Poland, Czechoslovakia, Hungary, Denmark, Norway, Sweden and other European countries whose native languages are not so generally familiar in the scientific world as are English, German and the romance languages; and that farther east, the Japanese, and in recent years the Chinese, are doing work to which we all need ready access. To insist upon any one, two or three languages (notably English, French and German) as valid for the publication of diagnoses, to the exclusion of other modern tongues, would inevitably stir nationalistic and racial opposition by many whose work we all ought to understand and to follow. Practically all the fundamental works of taxonomy (Linnaeus, *Genera Plantarum* and *Species Plantarum;* Hedwig, *Species Muscorum;* Persoon, *Synopsis methodica Fungorum;* DeCandolle, *Prodromus;* Fries, *Systema mycologicum;* Kunth, *Enumeratio Plantarum;* Bentham & Hooker, *Genera Plantarum;* Saccardo, *Sylloge;* Engler,

Das Pflanzenreich; etc., etc.) have at least their diagnostic portions in Latin, so that every competent taxonomist must, of necessity, be able to decipher descriptions in that tongue. Therefore, the compromise was reached at Vienna of demanding that new *diagnoses* should be in Latin.

The final vote at Vienna was 105 in favor of the Latin diagnosis, 88 against it. Consequently, there was some justification for those who do not feel bound by majority rulings to argue that the vote was not decisive. In line with this opposition to the majority decision much important taxonomic work, notably by certain Americans and Japanese, has been issued with nationalistic fervor but with indifference to the convenience of others and in defiance of the rule; its authors balking at the Latin diagnosis in their own work, though glad to have it in the work of colleagues whose native languages they could not decipher. Accordingly, the subject was reopened for full discussion and reconsideration at the Fifth International Botanical Congress at Cambridge (England) in 1930. Various propositions were presented: to abandon the rule absolutely; to make it a recommendation rather than a rule; to add as alternative languages English, French and German; or to admit any language using Roman letters. No one desired to exclude the valuable publications, notably in the United States, from institutions which had not wholly accepted the old Article 36, especially in view of the fact that the original vote on that article had not been essentially unanimous.

In their communications to the Cambridge Congress the Russian botanists strongly urged the retention of the article, and recommendations from botanists regularly writing in the Latin alphabet were largely in favor of some such provision. When the actual deliberations on nomenclature were reached, certain fundamental alterations in the International Rules were made to meet the desires of those Americans who had not heretofore fully accepted the Rules; and the feeling was nearly unanimous, that, if the vote on the retention of Article 36 were decisive, the date of its application might, with propriety, be altered so that publications made during the period following the possibly indecisive vote at Vienna might be validated. Recognizing that the leading botanists of the world were much nearer than heretofore to a mutual understanding upon the necessary, but always perplexing, subject of nomenclature and very generally agreeing that some provision is necessary to insure to botanists of all races and tongues in-

telligent access to the taxonomic work done in all countries, the Congress reaffirmed the requirement of a Latin diagnosis but voted to change the date for application of Article 36 from January 1, 1908 to January 1, 1932, and to exclude the Bacteria from the provision of the rule, bacteriology having little in common with ordinary taxonomic work.

That the Congress was a remarkably representative one (though, of course, dominantly British) no one can question; the registration was approximately 1200, of whom about 200 were from the United States and Canada. The deliberations in the sessions on Nomenclature, presided over by Merrill of the New York Botanical Garden, were participated in by many outstanding taxonomists, representing about 30 nations, such experienced students, to mention a few whose work is familiar to Americans (and omitting the large representation from North America), as Briquet (Switzerland); Mangin, Moreau, Gagnepain, Guillaumain and Maire (France); Pampanini (Italy); Handel-Mazzetti, Janchen, Pfeiffer and Pia (Austria); von Degen (Hungary); Borza (Rumania); Domin and Podpera (Czechoslovakia); Diels, Harms, Schellenberg, Schneider, Mattfeld and Markgraf (Germany); Henrard, Jeswiet and Pulle (Holland); Naveau and Hauman (Belgium); Ostendfeld and Christensen (Denmark); Juel and Robert Fries (Sweden); Holmboe (Norway); Prain, Rendle, Hill, Ramsbottom, Stapf, Cotton, W. W. Smith, Craib, Davy, Sprague, Wilmott and Miss Green (Britain); Black (Australia); Allen (New Zealand); Parker (India); Chun (China). After prolonged and very free discussion the ballot, as shown by the unofficial record before us, indicated 371 votes in favor of, 24 opposed to, the requirement of the Latin diagnosis. This vote of 371 to 24 (a ratio of 15½ to 1) is far nearer to unanimity than the vote at Vienna, of 105 to 88 (a ratio of 11 to 9) and should be considered absolutely decisive.

Convinced that true progress in the science can be achieved only by the acceptance and conscientious following of the decisions of the overwhelming majority of taxonomists at duly constituted international congresses, the Editorial Board of Rhodora wishes to announce its purpose to accept the ruling that, beginning January 1, 1932, publication of names of new groups of plants (Bacteria excepted) will be valid only when they are accompanied by a Latin diagnosis. By a *diagnosis* is meant, not necessarily a long and detailed description, but at least a concise statement of the leading characters (the

diagnostic characters), which can, if desired, be made in a few lines. Authors are, therefore, asked, out of consideration for those of other linguistic stocks and in order that their publications may be valid, to see that any descriptions of new plants or new groups which they propose to publish in Rhodora, have at least a diagnosis in Latin. If contributors find themselves embarrassed by this requirement, they may supply an English diagnosis which, for the time being, at least, the Editorial Board will undertake to have converted (with charges at cost for matter of considerable length) into Latin.

CONCERNING SOME SPECIES OF CORNUS OF PHILIP MILLER

Oliver Atkins Farwell

Some years ago I had occasion to consult Philip Miller's Gardeners' Dictionary, Ed. 8 (1768). At that time I gave the volume a more or less cursory examination and marked certain species therein for future investigation. Amongst these were several species of *Cornus*, and especially *C. Amomum*. In Miller's discussion of this species he says: "The shoots of the fifth sort are of a beautiful red color in winter; and in summer, the leaves being large, of a whitish color on their under side, and the bunches of white flowers growing at the extremity of every branch, renders this shrub valuable; and in autumn, when the large bunches of blue berries are ripe, they make a fine appearance."

I was puzzled to understand how such a good description of *Cornus stolonifera* could apply to the current understanding of *C. Amomum*. Both species are rather frequent in Michigan, and I have put a large amount of study on the species in the field, and the more I have observed them, the less I could apply Miller's remarks to our Silky Cornel. A close study of Linn's description of *C. sericea*, which has universally been considered a synonym of Miller's species, indicated that he likewise was describing the same species with beautiful red shoots. Each, likewise, quoted the same plate of Plukenet (Phyt. Part 3, Table 169, Fig. 3) as a synonym, but the text each quoted was not identical. I finally wrote Mr. Mackenzie for information about the text matter, and he kindly sent me the full description of Plukenet. I also sent specimens of various species of *Cornus* to the British Museum, asking for comparisons with the plate of Plukenet,

and with herbarium specimens of Plukenet, Miller and Linn. Mr. A. W. Exell, of the British Museum, sent me a rough sketch of Plukenet's Fig. 3. I agree with both Mr. Exell and Mr. Mackenzie, that the figure represents *C. Amomum* as found in our local manuals; but as the color of the pubescence is not shown, it may fit equally well, as pointed out by Mr. Exell, either the variety with rusty pubescence (my No. 1810) or the one with silvery pubescence (my No. 4272). Mr. Exell reports further:

"There is a specimen in Hort. Sloane (206, p. 67) which is very similar to Plukenet's figure but not exactly so, so that one cannot be justified in assuming that it is the species figured without any further evidence."

The specimen is in a poor state of preservation, but has no rusty pubescence, and Mr. Exell thinks it would be identified with my No. 4272, with silvery pubescence. Mr. Exell informs me that Plukenet's specimens are at the British Museum, but that there is no specimen there that has ever been identified as the original of the figure 3 under discussion; also, that all that is extant of Miller's Herbarium is there, but that there are no specimens representing *C. Amomum, C. candidissima,* and *C. foemina;* and that the only way of identifying these species is through an interpretation of their descriptions. Also that if Miller ever preserved specimens of these species, they were either lost or destroyed before Miller's Herbarium came into the possession of the British Museum.

My No. 8534, Mr. Exell took to the Linnaean Herbarium, and finds "that it agrees perfectly with *Cornus sericea,* L." This No. 8534 is *C. stolonifera* Mx.!! Therefore, the Linnaean Herbarium specimen, the original of Linn's own description and the basis of his *C. sericea* is *C. stolonifera* Mx.!!—which later name must lapse into synonymy. The question now arises: is *C. sericea* L. identical with *C. Amomum* Mill.? There is no way of settling the question except by the comparison of Miller's description with specimens of *C. Amomum* and *C. stolonifera* of our manuals. The stems of the former are gray, and the shoots of the season dull purplish; the stems of the latter are bright red throughout. I would scarcely call the purplish seasonal shoots of *C. Amomum* "a beautiful red," nor would they be conspicuous in winter. On the other hand, the stems of *C. stolonifera* and the plant in general will answer fully to the excellent and characteristic description of Miller. I am constrained to construe *C. Amomum* Miller,

excluding Plukenet, as the same as *C. sericea* L., excl. Pluk., and both the same as *C. stolonifera* Mx.

Since *C. Amomum* Miller must be taken up for our Red Osier Dogwood (*C. stolonifera* Mx.), a new name must be found for the plant of Plukenet Alm. Bot., 121 (1696) and Phyt., Pt. 3, tab. 169, fig. 3 (1692). Fortunately it has received several, so that no new name has to be coined for it. There are two variations, one with rusty pubescence and one with silvery pubescence. It might be either, as pointed out by both Mr. Mackenzie and Mr. Exell, since the color of the pubescence is not shown. Mr. Exell, as pointed out above, says that the Sloane specimen is not exactly simi.ar to the Fig. 3 of Plukenet; but that it is identical with my No. 4272, which has silvery pubescence. From this it may be deduced that the Plukenet specimen had rusty pubescence. In order to place it definitely, I will so interpret it. I am indebted to Mr. A. Rehder, of the Arnold Arboretum, for a transcript of the original description of *C. cyanocarpus* Moench, which name, in so far as I am able to ascertain, is the oldest name applicable to the rusty-pubescent variation of the Silky Cornel.

Moench's original description is short and unsatisfactory, as it does not even mention the pubescence. It is as follows:—

Cornus, Cyanocarpus, foliis ovatis, integerrimis, baccis cyaneis.

It comes between *Cornus sericea* L. with white berries and *C. Amomum* Miller with blue berries, so that the author evidently thought it allied to the latter.

But Moench in the Methodus, 108 (1794) gives the following enlarged description:—

Cyanocarpus, drupis subovatis maturis violaceis; arborea, foliis oppositis subovalibus acuminatis, subtus rubiginoso-pubescentibus; cymis mediis pubescentibus; calyce glandula triplo longiore. Cornus Amomum, du Roi, Ehrhart, Beytr., 4 p. 15.

There can be no question about the application of this description to the variety with rusty pubescence, and it will validate the earlier publication in this sense.

The variation with silvery pubescence, likewise has received various names, perhaps the oldest of which is *C. lanuginosa* Mx., but it is better treated as a variety than as a distinct species, and may be known as C. cyanocarpus Moench, var. **albescens**, n. var.

C. CANDIDISSIMA Mill., l. c., No. 6. Some authors refer this species to *C. florida* L. and others to *C. paniculata* L'Hér. Miller describes it as follows:

Tree Dogwood with smooth, spear-shaped, pointed leaves, umbels smaller then the involucrum, and oval berries.

Those authors who refer this to *C. florida* Linn, do so probably because of the reference to an involucre in the description. But Miller listed *C. florida,* and in his discussion of it noted both white involucres and red ones, which leaves no other variety to be described as a new species. He certainly would not have made two species out of our Flowering Dogwood after mentioning all known variations of it under *C. florida.* Either the reference to an involucre is an error that went undetected, or it does not refer to such an involucre as is found in *C. florida.* I can not construe the leaves of *C. florida* as "spear-shaped." In the 7th Ed. (1759) Miller further says of this: "Female Dogwood of *America* with very white leaves, commonly called Swamp Dogwood." Swamp Dogwood is one of the common names of *C. paniculata;* I have never seen it applied, even as a book name, to the *C. florida.* In addition, I venture to assert that the specific name, *candidissima,* was suggested by "the very white leaves" of the "Swamp Dogwood" (*C. paniculata*). I would make *C. candidissima* Miller, the older name for *C. paniculata* L'Hér. and reduce the latter to synonymy.

C. FOEMINA Miller, l. c., No. 4. This has been interpreted as *C. stricta* Lam., and as *C. paniculata* L'Hér. There is little in the description, taken alone and by itself, to definitely interpret it. But when taken in connection with the description of *C. candidissima* there is no question as to what it is, namely, *C. stricta* Lam. In both the 7th and 8th editions, Miller calls it the *Virginia Dogwood.* The whole trend of the description is toward *C. stricta* Lam., which name also falls into synonymy.

I wish heartily to thank the various gentlemen mentioned above for able assistance generously rendered.

The species considered are given below as I have found them in Michigan.

CYNOXYLON FLORIDA (L.) Raf. FLOWERING DOGWOOD. Frequent in woods. Detroit, No. 1561, May 26, 1897; Rockwood, Nos. 4148, May 21, 1916, and 4786, Oct. 26, 1917.

CORNUS AMOMUM Miller, l. c., No. 5. (excl. Pluk.). RED OSIER DOG-

wood; Kinnikinnik. *C. sericea* Linn. Mant. II. 199 (1771) (excl. Pluk.) and Herb.; *C. stolonifera* Mx., Fl. Bor.-Amer. I. 92 (1803). Keweenaw Co., No. 127, July 10, 1884; Birmingham, No. 127b, Sept. 6, 1903; Parkedale, Nos. 2649, June 9 and 3233, Oct. 27, 1912; Rochester, No. 2797, June 30, 1912; Due West, No. 8587, Sept. 10, 1929; Fenton, No. 8534, Aug. 13, 1929.

C. cyanocarpus Moench, Verz. Ausl. 27 (1785); Meth. 108 (1794). Silky Cornel. *C. caerulea* Lam., Ency. II. 116–117 (1786);? *C. rubiginosa* Ehrh., Beitr. IV. 15 (1789). Pluk., *Cornus Americana sylvestris*, etc., Phyt., Part 3, t. 169, f. 3 (1692) and *Cornus foemina, Laurifolia*, etc., Alm. Bot., 121 (1696).—Pubescence on petioles, midrib, etc., rusty.—Detroit, No. 1810, Aug. 22, 1903; Livonia, No. 8604, Sept. 17, 1929.

Var. albescens Farwell. ? *C. lanuginosa* Mx., l. c.; *C. polygamus* Raf., Fl. Ludv., 78, No. 247 (1817); *C. obliqua* Raf., Ann. Nat. 13, (1820); *C. Purpusi* Koehne, Gartenfl. 338 (1899); Hort. Sloane (206, p. 67).—Pubescence on petioles, etc., silvery, inflorescence more polygamo-dioecious; berries darker.—Tacoma, No. 4272, July 2, 1916; Detroit, Nos. 4279½ July 2 and 4403½ Aug. 27, 1916; Fenton, No. 8536, Aug. 13, 1929; Bloomfield, No. 8571, Sept. 3, 1929.

C. candidissima Mill., l. c., No. 6. White or Swamp Dogwood. *C. racemosa* Lam., l. c., 116; *C. paniculata* L'Hér., Cornus, 9, t. 5. (1788). Detroit: Belle Isle, No. 1172a, Aug. 6, 1892; Linden Park, No. 1809b, Aug. 15, 1903; Mack Ave., No. 2023a, June 16, 1907; Parkedale: No. 2740, June 23, 1912; Nos. 3476 and 3479, June 15, 1913; No. 4419⅓ Sept. 3, 1916; Rochester: Nos. 3464, 3467, 3469, June 15, 1913; No. 4657, Sept. 27, 1917; Butts, No. 4639, Sept. 23, 1917; Ypsilanti, No. 5251½, June 15, 1919.

C. foemina Mill., l. c., No. 4. Virginia Dogwood. *C. stricta* Lam., l. c.; *C. fastigiata* Mx., l. c. Not known in Michigan.

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Detroit, Michigan.

NOTES FROM THE HERBARIUM OF THE UNIVERSITY OF WISCONSIN—VI

Norman C. Fassett

Elatine triandra Schkuhr, var. **americana** (Pursh) n. comb. *Peplis americana* Pursh, Fl. Am. Sept. i. 238 (1814). *Elatine americana* Arnott, Edinb. Journ. Nat. & Geogr. Sci. i. 431 (1830); Fernald, Rhodora xix. 12 (1917); Svenson, Rhodora xxvi. 221 (1925); Fassett, Proc. Boston Soc. Nat. Hist. xxxix. 100 (1928); not of most American authors.

In taking up *E. americana* as distinct from *E. triandra,* Fernald contrasted the obovate to broadly spatulate leaves of the former with the linear to linear-spatulate leaves of the latter, and emphasized a difference in size also. *E. triandra,* whose only station in the Atlantic states is "the bottom of a little pond" in a park at Skowhegan, Maine, is described as often growing to a height of 2 dm., with long internodes. This would appear to be sufficiently distinct from the dwarf *E. americana.* The discovery of *E. triandra* in Wisconsin[1] has given opportunity for a field study of this species. One form is tall and elongate like the Skowhegan plant, and is evidently f. *callitrichoides,* at least as described by Hegi.[2] The leaves reach 1.3 cm. in length and 3 mm. in breadth, agreeing essentially with the measurements given by Fernald.[3] Besides this aquatic form, however, there is a terrestrial plant closely resembling the *E. americana* of estuaries from Delaware to New Brunswick. The leaves are at most 5 mm. long, and differ from those of *E. americana* only in being more linear.

The lack of an elongate aquatic form of the estuarine plant has a parallel in the case of *Eriocaulon. E. septangulare,* growing sometimes in as much as 2 m. of water, produces elongate scapes raising the flowering heads to the surface. But the doubtfully distinct *E. Parkeri* of estuaries, alternately deeply submerged and left stranded on the mud, remains short and stocky like the *E. septangulare* found on the shore. Since *E. triandra* var. *americana* is occasionally found on pond-shores in Delaware and Connecticut, an aquatic state like forma *callitrichoides* should be sought in these regions.

Treated as an offshoot of the European, Cordilleran, and rarely middlewestern plant, *E. triandra,* var. *americana* is more easily understood in its occurrence on the estuaries of the northeastern coast than when its range was discussed by the present writer. On page 105 of his paper, the author listed *Tillaea aquatica, Gentiana Victorinii,* and *Limosella subulata* with the following words: "A few species, European or Cordilleran in their affinities, appear to have survived the last glaciation on the unglaciated edge of the continental shelf, and are found at present on land neighboring the now submerged edge of this shelf, and on estuaries." *E. triandra,* including its variety, has a range similar to that of *Tillaea aquatica* in Europe

[1] Trans. Wis. Acad. of Sci. Arts & Lett. xxv. 199–200 (1930).
[2] Ill. Fl. Mitt.-Eu. v. 539 (1926).
[3] If we assume that in line 23, page 13, in Fernald l. c., "dm." is a misprint for "cm."

and North America,[1] and var. *americana* has somewhat the relation to *E. triandra* that *Limosella subulata* has to *L. aquatica*.[2]

On July 12, 1923, Dr. J. J. Davis observed at Durand, Wisconsin, an *Angelica* which had essentially the character of *A. atropurpurea*, but whose leaflets were velvety-pubescent beneath. Each succeeding year has shown more collections of this plant by the same worker, whose observations culminated in the opinion that the typical glabrous-leaved *A. atropurpurea* was confined, in Wisconsin, to the southeastern part of the state, and that the plants of the central, northern, and western parts all had more or less pubescent leaflets.

Study of his plants by the present writer confirms this opinion, and fails to show further differences with the exception of a small distinction in the veins of the upper surfaces, which are more strongly ciliate-scabrous on the pubescent plant. Meagre flowering material indicates that the anther of the glabrous plant is 0.6–0.8 mm. long while that of the pubescent plant is 0.3–0.4 mm. long, but this must be checked with more collections. Comparison of fruits of the same age fails to show any constant difference. This seems best treated, then, as an extreme occurring toward the western edge of the range of the species.

Angelica atropurpurea L., var. **occidentalis**, n. var., foliolis subtus in nervis et saepe in spatiis inter nervos pubescentibus, supra nervis scabris-ciliatibus.—Wisconsin: Washburn Co.: Birchwood, July 27, 1928, *J. J. Davis*. Sawyer Co.: Couderay, July 30, 1928, *Davis*. Polk Co.: Balsam Lake, July 25, 1924, *Davis*. Barron Co.: Barron, September 5, 1929, *Fassett*, no. 8944. Pierce Co.: Spring Valley, July 13, 1925, *Davis*. Pepin Co.: Durand, July 12, 1923, *Davis* (type in Herb. Univ. of Wis.). Oneida Co.: Tripoli, August 17, 1925, *Davis*. Portage Co.: Plover, August 25, 1917, *Davis*. Monroe Co.: Tomah, July 2, 1926, *Davis*. Iowa Co.: Dodgeville, June 17, 1925, *Davis*. Lafayette Co.: Argyle, June 22, 1925, *Davis*. Dane Co.: Klevenville, July 12, 1929, *Davis;* Madison, July 2, 1907, *J. R. Heddle*, no. 498, and July 26, 1909, no. 1T132; Token Creek, July 25, 1927, *Davis*. Green Co.: Browntown, September 22, 1926, *Davis*. Brown Co.: Fort Howard, June 22, 1886, *J. H. Schuette*.

Typical *A. atropurpurea* occurs in Wisconsin in the southeastern part only, with the following stations represented: Lafayette Co.: Gratiot, July 1, 1927, *Davis;* South Wayne, June 27, 1927, *Davis*. Green Co.: Brodhead, September 16, 1926, *Davis*. Jefferson Co.:

[1] Proc. Boston Soc. Nat. Hist. xxxix. 105, and pl. 13, fig. 2 (1928).
[2] Ibid., pp. 105–106, and pl. 13, fig. 4.

Jefferson, June 8, 1929, *Fassett*, no. 8422. WAUKESHA CO.: [probably Muskego] June 22, 1928, *Elizabeth Ehrler*. MILWAUKEE CO.: Milwaukee, *I. A. Lapham*. RACINE CO.: Racine, August 29, 1926, *Davis*.

Gnaphalium saxicola, n. sp., planta 5–30 dm. alta; caulis tomento laxo flocculoso saepe capillis extendentibus; foliis late oblanceolatis marginibus non crispis nec revolutis, supra vix glandulosis non papillosis, glabris vel sparse tomentosis, subtus sparse tomentosis vel glabris; tegulis linearibus, acutis, saepe in apice linearibus acuminatis dentibus incisis, 1–2-seriatis, laxioribus quam in *G. obtusifolio*.—WISCONSIN: Congress Hall, Dells of the Wisconsin River, 1866 (collector unknown); shady coulee near Mirror Lake, Delton, September 7, 1891, *R. H. True;* sandstone ledges, cold water canyon, Dells of the Wisconsin River, September 22, 1929, *N. C. Fassett, F. M. Uhler, & W. T. McLaughlin*, no. 9590 (TYPE in Herb. U. of Wis.).

This species is only 5–30 cm. tall; the tomentum of the stem is loose and flocculent; the leaves are broadly oblanceolate, rather bright green on both surfaces, sparsely tomentose or glabrate, without revolute or crisped margins; the linear acute involucral bracts are in only 1 or 2 rows, and are often cut at the tip into linear-acuminate teeth. Its closest relative, *G. obtusifolium*, is, in contrast, 1.5–7.5 dm. tall; the stem has a denser closer tomentum, composed in large part of hairs oriented up and down the stem; the leaves are linear-lanceolate, minutely elongate-papillate and glandular above, and densely tomentose beneath, with crisped and slightly revolute margins; the rounded or obtusely pointed bracts are closely imbricated in 3 or 4 rows, and entire or shallowly toothed at tip.

At the Dells of the Wisconsin River, near Kilbourn, glacial streams have cut deep gorges in the sandstone, whose varying degrees of hardness have produced many shelf-like ledges. Here, with *G. saxicola*, are *Epilobium glandulosum*, var. *perplexans*, *Cystopteris fragilis*, *Thelypteris fragrans*, var. *Hookeriana*, and a dwarf form of *Hypericum mutilum*. Here also grows *G. uliginosum*, with its bluish color and small heads imbedded in tomentum, always perfectly distinct from *G. saxicola* but *G. obtusifolium* does not seem to be present.

A specimen collected by L. Andrews in shade in Forest Park, Springfield, Massachusetts, loaned from the New England Botanical Club Herbarium through the kindness of Mr. C. A. Weatherby, shows an approach to *G. saxicola* in its small size and short nearly glabrous leaves. The three rows of broad involucral bracts and the dense tomentum of the stem, however, place it with *G. obtusifolium*.

MADISON, WISCONSIN.

CONCERNING A CALIFORNIAN CONVOLVULUS

Lily M. Perry

Convolvulus **simulans**, nom. nov. *Breweria minima* Gray, Proc. Am. Acad. xvii. 228 (1882). *Convolvulus pentapetaloides* Gray, Syn. Fl. N. Am. ii². 436 (1886), not L. Syst. Nat. ed. 12, iii. 229 (1768). Not *C. minimus* Aubl. (1775) nor Vitm. (1789).

Dr. Gray, receiving the American plant from Lower California, first described it as a new species of *Breweria*, but later (Syn. Fl. l. c.), probably on account of its close resemblance to the plates of the Mediterranean *Convolvulus pantapetaloides* (Cav. Ic. ii. 29, t. 123; Sibth. Fl. Graeca, t. 197), he identified it with the Mediterranean species and treated it as naturalized from southern Europe.

Although there is no doubt of the similarity between these species in general, they differ in rather significant details which seem to have been overlooked up to the present time. These differences, chiefly in floral characters, appear to be sufficiently constant to justify the separation of the Californian and Lower Californian material as a species; and since the specific name *Convolvulus minimus* is already pre-empted, the name *C. simulans* is here proposed. The following is a summary of the contrasting characters of the two and will perhaps be helpful in distinguishing these entities:

Bracts minute (1–2 mm. long), glabrous and scarious: calyx glabrous; sepals uniform, broadly ovate, with wide scarious margins, apiculate: corolla (in bud) densely pubescent; lobes obtusish, with salient acuminate angles .... *C. pentapetaloides.*

Bracts larger (3–4, often to 9 mm. long), pubescent and foliaceous: calyx pubescent; sepals dimorphic, the two outer narrowly oblong, herbaceous, the three inner much broader, oblong-obovate and inconspicuously apiculate, with narrow scarious margins: corolla (in bud) scarcely if at all pubescent; lobes subovate, obtuse .... *C. simulans.*

Convolvulus simulans is apparently indigenous to western North America and ranges near the coast from the vicinity of San Francisco Bay southward into northern Lower California. It has been collected most frequently south of Point Conception. The specimens in the Gray Herbarium are as follows:

California: Antioch, June, 1884, *Mrs. Curran;* Cholame, San Luis Obispo Co., June, 1887, *Lemmon, no. 4618;* Estrella, San Luis Obispo Co., May, 1885, *Jared;* Santa Barbara, 1879, *Mrs. Cooper;* San Diego, May 1, 1902, *Brandegee, no. 1665;* below San Diego, 1882, *Jones;* Sweetwater Hills, San Diego Co., May 9, 1884, *Orcutt;* La Jolla, April 13, 1914, *Clements, no. 86.*

Lower California: hills, 1882, *Pringle;* 1882, *Jones, Parry, Pringle* (type of *Breweria minima*).

The writer is indebted to Mr. Rimo Bacigalupi for comparing the Californian material with the type of *Convolvulus pentapetaloides* in the Linnean collection at Burlington House, London.

Gray Herbarium.

MEESEA TRIQUETRA[1]

William Campbell Steere

(Plate 205)

About twelve miles north of Ann Arbor lies a small post-glacial pond known as Mud Lake. The margins have long since been encroached upon by various aquatic plants, so that now only a very limited area of open water remains, which is completely surrounded by a floating mat of cat-tails and sedges. This zone is surrounded in turn by a dense swamp of tamaracks and spruces growing out of the wet, Sphagnum-covered floor. The general region is probably the richest in bryophytes of any in the immediate vicinity of the University of Michigan. Pennington (1) has published a detailed ecological description of this interesting area.

It was while wading about on the firmer parts of the undulating mat that the writer had the good fortune to run across a fine clump of *Meesea triquetra* (L.) Ångstr. (*Meesea tristicha* B. & S.) with mature sporophytes. This is the second locality in Michigan from which this uncommon species has been recorded, Nichols (2) having reported it from Cheboygan County. It is apparently a circumboreal species, since it has been reported from widely separated stations in Europe, Asia and the northern part of this continent.

Because of the unique and characteristic appearance of this beautiful moss, it is very easily recognized in the field and will hardly be confused with any other species, once it has been determined. Nevertheless, it is rather puzzling to one who has never seen the plant before, for although it is readily identified by the keys in the current manuals, most of the descriptions are so unsatisfactory that one does not feel secure until he has confirmed his determination by comparison with herbarium material.

[1] Paper from the Department of Botany, University of Michigan.

The salient features of the gametophyte are as follows: (*1*) The distant, strongly squarrose leaves are markedly three ranked, so that, when viewed from above, the tips of sterile plants resemble small three-pointed stars. Of our American manuals, only that of Jennings (3) makes use of this very important diagnostic character, which makes even sterile specimens easy to recognize, and from which the specific name is derived. (*2*) The serrate margins of the lanceolate, acute leaves further distinguish this from any other species.

The sporophyte is characterized by a very long seta (3–4 cm.) which bears a pear-shaped capsule inclined from an erect, swollen collum or neck. In southern Michigan the spores mature early in July.

The above macroscopic characteristics, together with the bog habitat, should serve to make *Meesea triquetra* easy to identify, even without the examination of the peristome required by most keys. The distinctive peristome characteristics are valuable, however, in confirmation of the determination; the 16 narrow segments of the inner peristome being two or three times as long as the 16 teeth of the outer.

The writer knows no figure which adequately illustrates the gametophyte, although an excellent idea of the general sporophytic characteristics is given by the plate of *Meesea tristicha* in Bryologia Europaea (4) which is reproduced by Grout (5). The peculiar features of the peristome are well figured by Limpricht (6).

The accompanying natural size photograph (Plate 205) taken July 3, 1930, will therefore supplement previous illustrations and demonstrate some of the diagnostic points.

Temple University,
Philadelphia, Pennsylvania.

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(1) Pennington, L. H. 1906. Plant distribution at Mud Lake. Annual Rep. Mich. Acad. Sci. **8**: 54–63.
(2) Nichols, G. E. 1922. The bryophytes of Michigan, with particular reference to the Douglas Lake region. Bryologist **25**: 41–58.
(3) Jennings, O. E. 1913. A Manual of the Mosses of Western Pennsylvania. Published by the author, Pittsburgh, Penna.
(4) Schimper, W. 1836–1855. Bryologia Europaea seu Genera Muscorum Europaeorum monographice illustrata auctoribus P. Bruch, W. Schimper et T. Gümbel. Stuttgart.
(5) Grout, A. J. 1903. Mosses with Hand-Lens and Microscope. Published by the author, New York City.
(6) Limpricht, K. G. 1895–1904. Die Laubmoose Deutschlands, Oesterreichs und der Schweiz. Rabenhorst's Kryptogamen-Flora. Leipzig.

LITTORELLA AMERICANA IN WASHINGTON COUNTY, MAINE.—During the thirty-fifth field meeting of the Josselyn Botanical Society in July 1930, a party consisting of Miss Sue L. Gordon, Mr. H. M. W. Haven, Miss Annie F. Nichols, Dr. F. H. Steinmetz and the writer, visited a small "kettle" or "sink" pond in township No. 18 in the Epping Plains (of the U. S. Coast Survey[1] reports), or the Blueberry Barrens of the Cherryfield Quadrangle; though this pond, which is located a little way to the north of the western end of Schoodic Lake, is unnamed on the quadrangle mentioned, we learned that it is locally known as "Little Schoodic Pond." On both the western and the southwestern shores of this pond we found in considerable quantity *Littorella americana* Fernald,[2] growing on the wet strand in silt-filled gravel. The plants were healthy and flowering well. The occurrence of this rare plant so near the terminus of this branch of the great Katahdin esker system[3] is indeed most interesting, and suggestive of a possible range of stations along this esker system, since the plant is known to occur in two other ponds farther north along the same system,[4] in the present Penobscot basin.—ARTHUR H. NORTON, Museum of Natural History, Portland, Maine.

A NEW STATION FOR LITTORELLA AMERICANA.—Professor M. L. Fernald describes the North American *Littorella* in RHODORA, xx. 61–62 as distinct from the European *L. uniflora* (L.) Asch. He also gives its habitat and cites the known stations for the species. He reëstablishes the station in Nova Scotia on the shores of Grand Lake and reports it in RHODORA xxiii. 135. During the past summer it was found on July 11 by Mr. Arthur Norton[5] on the shores of a small "kettle hole" pond in Washington County, Maine. Ten days later it was collected in blossom along the shores of the south end of Pushaw Pond near Orono, Maine by the writer. It was later found at three other points on the shallow shores of the same pond. On September 10th large areas of it were found in various stages of development near a point locally known as Sandy Beach. It was collected

[1] 1858, Bache, Rept. U. S. Coast Surv. for 1857, 302–305; pl. 3.

[2] 1918, Fernald, RHODORA, **20,** 61–62.

[3] 1899, Stone, U. S. Geol. Surv Mon. xxxiv, 104–116.

[4] 1918, Fernald, RHODORA, **20,** 62 (Chemo Pond); and 1931, Steinmetz, Rhodora, **33,** 79 (Pushaw Pond).

[5] 1931, Norton, RHODORA xxxiii. 79.

as late as November 1st. near Kukunsook landing. Undoubtedly conditions have been favorable for its development along the shores of this pond during the past season because of the slow but constant lowering of the water level.—F. H. Steinmetz, University of Maine, Orono, Maine.

Cuscuta Polygonorum in New England.—Last autumn the writer collected a *Cuscuta* in his wood lot at Goose Pond, Concord, Massachusetts, which attracted attention as differing slightly in appearance from the usual run of *C. Gronovii*. The fact that it was growing on *Polygonum acre* seemed of little significance until a recent dissection disclosed corolla- and stamen-characters of the southern *C. Polygonorum* Engelm. The five-parted corolla with acuminate lobes, the obscure scales scarcely visible with a hand lens, and the long stamens at least equaling the tips of the corolla-lobes, seemed to fit no other species. Reference to Yuncker's monograph on North American *Cuscuta*[1] merely strengthened this view. By request, Mr. C. A. Weatherby of the Gray Herbarium made an independent dissection and reported: "I think there is no doubt at all that your Cuscuta is *C. Polygonorum* Engelm."

The range for this species has long been considered as: Delaware and Pennsylvania to Minnesota and southward. A recent discovery of the plant on Long Island, New York,[2] tends to allay somewhat the natural suspicion with which the alleged Concord station must be regarded. Any addition to the flora of New England, particularly if it be a *Cuscuta* several hundred miles north of its "normal" range, must be supported by incontestable evidence. At present, the writer's single sheet in the Club Herbarium constitutes the sole proof of the existence of this plant north of Long Island. Perhaps local students may be tempted to boil up their *Cuscuta* reliquiae in a search for other New England stations of *C. Polygonorum*. It may prove to be a widely distributed plant which hitherto has been entirely overlooked. —Richard J. Eaton, Boston, Massachusetts.

[1] T. G. Yuncker: Revision of N. A. & West Indian Species of Cuscuta.
[2] W. C. Ferguson: Flora of Long Island, Bull. Torrey Club, **53**: 307, 1926.

Volume 33, no. 386, including pages 25 to 64 and plate 204, was issued 30 January, 1931.

Meesea triquetra × 1.

APR 20 1931

Rhodora

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THE SEEDLING OF HAMAMELIS VIRGINIANA L.

THEO. HOLM

(Plates 206 and 207)

SEEDLINGS of trees and shrubs generally show a very uniform development, and the deviations depend mainly on the cotyledons being epigeic or hypogeic, and on the shape of the primary leaves, which sometimes differ from that of the mature tree or shrub. The internal structure, on the other hand, exhibits frequently several points of interest, and especially with regard to the early appearance of certain structural characters, which become more or less modified in the mature plant. The secondary increase in thickness of the primary root and the stem, including the hypocotyl, naturally involves several changes in the structure, beside that the tissues of the leaf are frequently subject to modification, when being exposed to change of environment, shade and light especially.

Seedlings of *Hamamelideae* are not mentioned by Lubbock;[1] he figures and describes *Bucklandia propulnea* R. Br., but this genus is a member of *Liquidambareae* according to Baillon. In *Hamamelis Virginiana* the first leaf of the seedling (FIG. 2) is large for the size of the plant, subcordate, acuminate, and distinctly crenate; the second leaf (FIG. 3) is much smaller, ovate and short-pointed; in the ultimate leaves (FIG. 1) the crenation is less pronounced, the base is oblique, and the apex varies from short-pointed to almost obtuse. The average size of the ultimate leaves aggregates about 9 cm. in length, and 6 cm. in width, but occasionally the inflorescences may be subtended by leaves measuring up to 13½ cm. in length, and 10 cm. in width. The

[1] Lubbock, John. A Contribution to our Knowledge of Seedlings. Vol. 1, London, 1892, p. 521.

vernation is not "involute" as stated by Sargent (Silva, V: 1893), but "plicate." When comparing the internal structure of the seedling, during the first season, with that of the mature tree (or tall shrub), the development of the various tissues may be described as follows.

The Root-system

In the primary root of the young seedling at the stage figured (fig. 2), collected early in May, increase in thickness has already taken place, but only within the stele; the peripheral tissues from the epidermis to endodermis incl. are still intact. The epidermis is very small-celled, destitute of hairs, and the cell-walls are of a deep brown color; there is a thin-walled exodermis, well marked by the lumen being somewhat wider than that of the adjoining cortex. The cortical parenchyma consists of eight compact strata of roundish cells with no contents of starch or crystals; the endodermis is well preserved, thin-walled and relatively large-celled, but contains no starch. At the expense of most of the pericambium the stele presents a dense mass of leptome and hadrome in deep rays with several strata of typical libriform, enclosing a narrow, slightly thick-walled pith. In the capillary, lateral roots of the same specimen the stele shows the original structure, which is diarch; the cortex presents a narrower zone, but otherwise the structure is as described above.

At the close of the first season the primary root has grown to a considerable length, and increased in thickness. The peripheral tissues from epidermis to endodermis, inclusive, have been replaced by many strata of homogeneous, thin-walled cork of the usual structure, and by a secondary thick-walled cortical parenchyma of only two layers, containing large deposits of starch, both tissues having originated from the pericambial meristem. The stele shows the same structure as described above, but the libriform is more thick-walled.

If we compare now the older roots of mature specimens, of the flowering shrub, for instance, we notice a somewhat modified structure. The cork and the secondary cortex represent broader zones, the latter containing starch in abundance, beside large, single rhombic crystals of calcium-oxalate. Moreover, we notice a number of isolated stereids and sclereids scattered throughout this parenchyma, beside some more definite strands of stereome outside the leptome. With regard to the medullary rays these contain large, single crystals and starch. The libriform shows a somewhat peculiar structure, the cells having

an inner, quite thick, gelatinous layer, more or less separated from the lignified part of the cell-wall, thus representing the so-called "Gallert-schicht," described by De Bary;[1] it is a structure of somewhat irregular occurrence, being not exhibited by all the libriform-cells in many plants. As a matter of fact, De Bary calls attention to the occurrence of such cells together with normal libriform in the same annual ring of the trunk of certain trees, and a like variation exists also in roots. For in our *Hamamelis* we found such cells quite frequent in the innermost strata of the hadrome in the root, intermixed with normal libriform. Characteristic of the root structure is thus the early increase within the stele of the primary root of the seedling, while the peripheral tissues are still intact, succeeded during the first autumn by the replacement of these tissues by cork and a secondary cortical parenchyma. In roots of the mature tree stereids and sclereids appear in the secondary cortex, and part of the libriform shows the peculiar, gelatinous, inner layer, recorded by De Bary from the trunks of certain trees.

The Stem

The hypocotyl of the young seedling is tall, cylindric, perfectly glabrous, but not smooth, the cuticle forming numerous, longitudinal ridges from base to apex. The epidermis is thick-walled (the outer wall), and a thin-walled cork of three strata has developed from hypodermal callenchyma (FIG. 4); the cork-cells show the general form, being stretched tangentially. The cortex is heterogeneous, consisting of two to three strata of collenchyma and of about six compact layers of thin-walled parenchyma, of which the three peripheral strata are rich in chlorophyll. There is a distinct, thin-walled endodermis, containing starch; the pericycle is composed of isolated strands of stereome in two to three layers interspersed with thin-walled parenchyma. The stele represents a compact cylinder of leptome, cambium and deep rays of hadrome with narrow, medullary rays (1–2 rows), and some libriform, slightly thick-walled. The pith is thin-walled, solid, rich in starch.

The epicotyl, the only internode of the young seedling, is obtusely triangular, and hairy with stellate hairs; the cuticle and the epidermis show the same structure as in the hypocotyl, but no cork is developed; the cortex is heterogeneous as described above, but several of the cells

[1] De Bary, A. Vergleichende Anatomie der Vegetations-organe der Phanerogamen und Farne. Leipzig, 1877, p. 497.

contain a brown substance, and large aggregated crystals of calcium-oxalate. The endodermis, pericycle and stele show the same structure as described above, but the outline of the stele is triangular, the three primordial mestome-strands being much thicker than the interfascicular.

At the close of the first season several (4–5) internodes have been developed, and in these the epidermis has become somewhat compressed, covering a broad zone of thin-walled cork, the cells of which are stretched radially as shown in FIGURE 6. The cortex consists of collenchyma and thick-walled parenchyma, both containing crystals, single in the former, but single and aggregated in the latter, besides deposits of starch. No endodermis could be distinguished, but a closed pericycle of stereome in about three layers. The stele shows the same structure as in the young seedling, but the libriform and the pith are thick-walled; the latter contains starch.

In passing to describe the structure of the branches of the mature shrub or tree, the long, slender internodes of a branch, about nine months old, show the epidermis still preserved, thick-walled and small-celled, covering four thin-walled layers of cork with the cells radially stretched (FIG. 6). The cortex is of five hypodermal strata of collenchyma surrounding three strata of moderately thickened parenchyma, of which several cells contain a brown, amorphous substance; while only single crystals were observed in the collenchyma, both single and aggregated were found in the parenchyma. No endodermis could be distinguished, but an almost continuous pericycle of three to four strata of stereome intermixed with sclereids; the stereids showed the inner cell-wall beginning to become gelatinous. Corresponding with the circular outline of the branch (in cross-section) the stele is almost round, but shows the three primary mestome-strands very plainly. The mestome is very compact, and libriform is especially well represented in the interfascicular tissue. A large, small-celled and thick-walled endoxyle covers the inner face of the three primary mestome-strands. With regard to the leptome this contains much thin-walled parenchyma forming rays between the strands of sieve-tubes, frequently containing a brown substance, but neither starch nor crystals; the hadrome contains much libriform, beginning to show the gelatinous structure of the inner cell-wall; the vessels are relatively narrow, polyedric rather than circular in cross-sections, and the medullary rays are of only one to two rows. The pith is thick-walled, and con-

tains starch besides a brown substance, but no crystals. Viewed in longitudinal sections the cork-cells are high, but very narrow; the sclereids form long rows between the stereids, and the crystals are contained in cells, forming continuous rows, generally close to the stereome; the libriform shows bordered pits very distinctly.

This structure recurs in the older branches with the exception, that a secondary cortical parenchyma has developed on the inner face of the pericycle, and contains single crystals of calcium-oxalate. Moreover the pith shows the cells very thick-walled, porous, and stretched radially, containing several aggregated crystals, but no starch.

The three-flowered peduncle is at the time of the flowering densely hairy with numerous stellate hairs, and the cross-section is circular with a circular stele. The cortical parenchyma is homogeneous, collenchymatic, and of 12–14 layers, containing both types of crystals. The endodermis is fairly distinct, but destitute of starch, and no pericycle is developed.

Among the structures characteristic of the stem, when examined from the seedling stage to the mature tree, the following may be mentioned. The cuticle forming longitudinal ridges on the hypocotyl and the epicotyl; the absence of hairs from the hypocotyl; the development of stellate hairs on the epicotyl and subsequent internodes; the development of cork beginning in the young hypocotyl; the cortex being heterogeneous, *i. e.* collenchymatic and parenchymatic in the hypocotyl and in all the suceeding internodes, except in the floral peduncle, where the cortex is collenchymatic all through; endodermis being distinct in the hypocotyl, epicotyl and in the floral peduncle, but absent from the other internodes; the pericycle being purely stereomatic in the seedling, but interspersed with sclereids in the young branches of the tree, and absent from the floral peduncle; the stereids and the libriform showing a gelatinous, inner wall in the branches of the tree; a well-developed endoxyle in the young branches of the tree; the cells of the pith being very thick-walled and stretched radially (in cross-sections) in old branches. The distribution of crystals of calcium-oxalate is very unequal: *viz.*, none in the hypocotyl; aggregated in the cortex and pith of the epicotyl; single crystals in the cortex of the apical internodes of the seedling during the autumn; single and aggregated in the lower internodes during autumn; aggregated and single in the primary parenchymatic cortex of young

branches of the tree; single in the collenchymatic; aggregated in the pith and primary cortex of old branches of the tree; single in the secondary cortex of all branches; single and aggregated in the collenchymatic cortex of the floral peduncle.

The Leaves

The relatively large, epigeric cotyledons (fig. 2) have short petioles, which, at the characteristic point, *i. e.* just beneath the leaf-blade, are triangular in cross-section, and destitute of hairs. The cuticle is wrinkled on both faces, and the outer wall of epidermis is slightly thickened. The cortex consists of 15–20 strata of roundish cells rich in chlorophyll, and several cells contain a brown substance, but no crystals were observed; the hypodermal stratum of cortex is slightly collenchymatic on the dorsal face. The three mestome-strands are collateral and situated in a single band close to each other; a starch-bearing endodermis covers the leptome-side, and inside the endodermis are three arches of thin-walled stereome corresponding with the leptome. The blade of the cotyledon is also glabrous, and covered by a thin, smooth cuticle; the epidermis is thin-walled in the lateral parts of the blade, but slightly thick-walled (the outer cell-wall) above and beneath the midrib. Viewed in superficial sections the lateral cell-walls of epidermis are undulate on both faces of the blade, especially on the dorsal face; the stomata are confined to the dorsal face, with generally one rectangular subsidiary cell and four ordinary epidermis-cells. A few strata of collenchyma, hypodermal, are located beneath the midrib, passing into a small water-storage tissue of two to three strata. The chlorenchyma consists of one ventral stratum of very short and plump palisade-cells, some of which show the peculiar funnel-like shape, which recurs, but much more frequently, in the first green leaf succeeding the cotyledons; this stratum contains much more chlorophyll than the adjoining pneumatic tissue, which consists of about eight layers of oblong to roundish cells with wide intercellular spaces; the palisade-tissue passes uninterruptedly across the midrib. The midrib contains a single, arch-shaped, collateral mestome-strand, of which the leptome is supported by an arch of thin-walled stereome; no crystals of calcium-oxalate were observed in the cotyledon.

The primary leaf of the young seedling (fig. 2) has a short petiole, which is hemicylindric in cross-sections, the ventral face flat; it is hairy on both faces with stellate hairs. The cuticle is thin, nearly

smooth, and the epidermis is slightly thick-walled. The cortex consists of five to six strata of thin-walled, roundish cells with chlorophyll, but no collenchyma was observed. The mestome-strands form a stele, almost circular in cross-section, and surrounded by a continuous sheath of stereome in three to four layers; a relatively broad, thin-walled pith occupies the center of the stele, containing a little starch, but no crystals. The leaf-blade of the primary leaf of same seedling shows a typical dorsiventral structure as to stomata and chlorenchyma. The cuticle is thin, smooth; the stomata are confined to the dorsal face; they are slightly raised, and have a wide air-chamber; they show three distinct structures: they are surrounded by five cells of which two are rectangular and parallel with the stoma, the others being ordinary epidermal cells with undulate lateral walls; or only one cell is rectangular, the other four being larger and with the lateral walls undulate; or there are only four cells, of which the two are much smaller than the others, but of irregular shape, and with the walls undulate. Viewed in superficial sections the lateral walls of epidermis are prominently undulate on both faces of the blade; in cross-section epidermis is thin-walled on both faces, with about the same lumen; stellate, and simple, unbranched hairs are frequent on both faces of the blade, the simple being unicellular, very long, and sharply pointed. There is one layer of palisade-tissue (FIG. 5), which is very open, and the cells are very short and much broader under the epidermis than where they touch the pneumatic tissue; the pneumatic tissue is of three to four layers of oblong to roundish cells with wide intercellular spaces; the chlorenchyma, especially the palisade-tissue, is rich in chlorophyll. The structure of this palisade-tissue is very different from the typical, because the cells are mostly of a funnel-like shape, as shown in the figure (FIG. 5). In describing the system of assimilation Haberlandt[1] calls special attention to this structure, the funnel-shaped cells, but according to this author, it is generally in the pneumatic tissue that this cell-form is represented in order to connect with a larger or smaller fascicle of true palisade cells so as to conduct the assimilated substances to the parenchyma sheaths of the mestome-strands. By Haberlandt these funnel-shaped cells are therefore called "Sammel- oder absorption-zellen," *i. e.* receiving cells; he cites several plants showing this structure of the uppermost stratum of the pneumatic tissue, for instance some ferns, but also several

[1] Haberlandt, G. Physiologische Pflanzenanatomie. Leipzig, 1896, p. 246 seq.

Dicotyledons: *Ficus, Juglans, Pulmonaria, Eranthis,* etc. But with regard to the typical palisade cells being replaced by funnel-shaped as in our *Hamamelis* (fig. 5) Haberlandt attributes this structure to sciaphilous plants especially, where the great width of the cells, directly beneath the ventral epidermis, favors an increased assimilation in the diffuse light of the shady environment. Several instances of this particular structure have been described and partly figured in our paper dealing with: Sciaphilous plant-types,[1] among these: *Orchis rotundifolia* Pursh, *Aster divaricatus* L., *Aristolochia Serpentaria* L., *Lepidagathis alopecuroides* R. Br., *Spiraea Aruncus* L., *Amphicarpaea monoica* (L.) Ell., *Stellaria pubera* Michx., etc. The very open structure of the pneumatic tissue in *Hamamelis* recurs in several sciaphilous plants, and by containing chlorophyll, even to a limited extent, it thus performs two functions: aerating and assimilating.

There is another peculiar structure to be observed in the chlorenchyma, namely the development of long, thick-walled sclereids (fig. 7), which, however, are more frequent in the leaves of the mature tree. Haberlandt (l. c. p. 141) describes the sclerenchyma and the various types of sclereids (a term proposed by Tschirch) which have been observed; he distinguishes between "brachy-, macro-, osteo- and astro-sclereids" in accordance with their shape. Of these forms the more or less isodiametric sclereids, the brachy-sclereids, are the most common, known especially from the pericycle of the stem of many herbaceous and woody plants, from the fruits of *Pomaceae*, and from the tuberous roots of *Dahlia, Paeonia* etc.; by Solereder[2] they are called "stone-cells." The sclereids in our *Hamamelis* represent the type "macro-sclereids," and are known from the leaves of many plants, more seldom from the stems (cortex and pith). Solereder calls this type "Spicular-zellen" (l. c. p. 919), and he enumerates the families in which they have been observed. The function of the sclereids is, according to Haberlandt, of a local, mechanical nature. This term proposed by Tschirch is more natural than that of some other authors, who under the category "idioblasts" include stone-cells, crystal-cells, oil-cells, resin-cells, etc., for instance Sachs,[3] Strassburger,[4] and others.

[1] Beihefte Bot. Centralbl. Vol. 44. Dresden, 1927.

[2] Solereder, Hans. Systematische Anatomie der Dicotyledonen. Stuttgart, 1899, p. 966.

[3] Sachs, Julius. Lehrbuch der Botanik, 4th ed. Leipzig, 1874, p. 85.

[4] Strassburger, E. Lehrbuch der Botanik. Jena, 1894, p. 71. (Strassburger, Noll, Schenck and Schimper).

The midrib forms an obtuse keel on the lower face of the leaf-blade, and contains a thin-walled water-storage-tissue of two to five strata, surrounding the single, arch-shaped mestome-strand. No endodermis was observed, but the leptome and the hadrome have a support of several layers of stereome forming two separate arches; the hadrome contains no libriform. A few single crystals were observed in the dorsal part of the water-storage-tissue. The lateral, thin veins are surrounded by green parenchyma-sheaths, inside of which some few stereids may be noticed on the leptome-side. The cells of the parenchyma-sheath border on the palisade- and the pneumatic-tissue.

The leaf of the full grown tree or large shrub shows the same structure of the the cuticle, epidermis and stomata as the primary leaf of the seedling; stellate hairs of two types, *viz.* four-armed with very thin cross-walls, and ten-armed, which are a little shorter and more thick-walled than the four-armed, and lack the cross-walls; of these types the former is the most frequent on the dorsal face, while the ten-armed occur on both faces of the blade. The chlorenchyma is developed as a typical palisade tissue of one layer (*P* in FIG. 7) of high cells rich in chlorophyll, and covering a relatively compact pneumatic tissue of about four to five strata with only a little chlorophyll; large macro-sclereids (FIG. 7) are frequent, extending from the ventral epidermis to the dorsal, and, sometimes, breaking through this; some few single crystals were observed in the palisade-tissue. The midrib (FIG. 8) forms a large, obtuse keel on the dorsal face of the leaf-blade, containing three strata of hypodermal collenchyma around the keel, and on the narrow, upper face, the chlorenchyma does not extend across the midrib, being interrupted by a large water-storage-tissue, surrounding a large stele, circular in cross-section, and an arch-shaped, collateral mestome-strand above this, and close to the ventral epidermis. A closed sheath of stereome in five to six layers surrounds the stele and the single mestome-strand; the leptome of the latter shows the normal, dorsal position; the center of the stele is occupied by a broad pith, containing many single, but only a few aggregated crystals of calcium-oxalate; similar crystals were also observed in the water-storage-tissue, besides macro-sclereids. This singular structure of the midrib recurs in the lateral veins, the secondaries, with the exception that there is a small opening on the ventral face of the stele, and that the ventral, arch-shaped mestome-strand above is wanting. In following the structure of the midrib towards the apex

of the leaf-blade, the composition is very different, there being only an arch of mestome, surrounded by a large, thin-walled parenchyma, and a completely closed sheath of stereome; a narrow arch of pith is located between the hadrome and the ventral portion of the stereome.

The petiole of the mature leaf is almost cylindric, and very hairy near the base of the blade. The cuticle is smooth, and the epidermis is of small, thick-walled cells. Three to five hypodermal strata of collenchyma surround a thin-walled cortex of about eight layers, very compact, and containing chlorophyll and crystals, single as well as aggregated, the former being most abundant near the stereomatic pericycle, which surrounds a central stele, corresponding exactly with that of the midrib of the leaf-blade.

When comparing the structure of the cotyledons, the primary leaf of the seedling, and the leaf of the mature tree, we observe the following points of interest. The petiole of the cotyledon contains three collateral mestome-strands, located in one band, while a typical stele occurs in the petiole of the primary leaf and of the leaf of the tree. The chlorenchyma consists of one layer of short palisade cells with several funnel-shaped, and of eight strata of open, pneumatic tissue in the cotyledon; of one layer of short, funnel-shaped cells covering a pneumatic tissue of three to four layers with wide intercellular spaces in the primary leaf; and of one layer of typical, compact palisades covering a pneumatic tissue of four to five compact strata in the leaf of the tree. Macro-sclereids were observed in the chlorenchyma of the primary leaf and of the leaf of the tree, but not in the cotyledons. The midrib of the cotyledon consists of one arch-shaped, collateral mestome-strand with a dorsal water-storage-tissue; that of the primary leaf shows the same structure, while in the leaf of the tree the midrib represents a stele, circular in cross-section, with a ventral, collateral mestome-strand, and with a large, dorsal water-storage-tissue. The crystals of calcium-oxalate are distributed as follows. Aggregated as well as single, rhombic were found in the cortex of the petiole of the leaf of the tree; only single crystals were observed in the chlorenchyma of the leaf of the tree, and in the water-storage-tissue of the midrib in the primary leaf; many single and a few aggregated crystals were observed in the pith of the stele in the leaf of the tree, and in the dorsal water-storage-tissue of same. No crystals were found in the cotyledons, nor in the petiole of the primary leaf.

We have thus in the seedling of *Hamamelis Virginiana* an illustra-

tion of the early appearance of some of the more important structures, noticeable in the root, stem and foliage. We have seen the development of cork and a secondary cortex in the root at the close of the first season, while stereids and brachy-sclereids do not appear in the secondary cortex before the roots are several years old. The development of stellate hairs begins on the epicotyl, while the cork, and the differentiation of the cortex into collenchyma and ordinary parenchyma already begins in the hypocotyl. The pericycle being purely stereomatic in the seedling, but interspersed with brachy-sclereids in the branches of the tree. The appearance of aggregated crystals in the epicotyl, and of single in the apical internodes of the seedling. With regard to the foliage we have seen that the cotyledons and the primary leaf lack a typical palisade-tissue, while such is well represented by the leaves of the tree; moreover the appearance of macrosclereids in the chlorenchyma of the primary leaf, recurring more frequently in the foliage of the tree; the singular structure of the midrib of the leaf of the tree representing a stele, while that of the cotyledons and the primary leaf contains only a single, arch-shaped mestome-strand; finally the occurrence of single crystals in the water-storage-tissue of the primary leaf, but of both single and aggregated in the various tissues of the leaves of the tree.

If we compare the structure of *Hamamelis* with that of *Liquidambar*, the total absence of secretory ducts from the former, and their presence in the latter constitutes an anatomical character of importance, and more so than the development of sclereids in the leaves of *Hamamelis*. It was principally upon the basis of the system of secretory ducts in *Liquidambar* and *Altingia* that Van Tieghem[1] segregated these genera from *Hamamelideae* (*Hamamelis, Rhodoleia*) as a small, very distinct group of very doubtful affinity; for even if the structure of the stem and leaf resembles that of *Dipterocarpeae* and *Simarubeae*, the root-structure does not agree with these. When combining these anatomical characteristics with the floral structure as represented by *Liquidambar* on the one side, and by *Hamamelis* on the other the segregation appears a very natural one. But considered by itself alone the anatomical structure, in this case the presence of ducts, would hardly be sufficient for warranting such segregation, because the development of secretory cells as well as secretory ducts may characterize all the members of certain families, or only

[1] Van Tieghem, Ph. Second mémoire sur les canaux sécréteurs des plantes. Aun. d. sc. nat. Bot. Série 7, Vol. 1. Paris, 1885, p. 86.

some of the genera or species. For instance, in the *Compositae* endodermal ducts occur in many of the *Tubuliflorae*, in several of the *Labiatiflorae*, but only in a few *Cichoriaceae;* in the *Cornaceae* ducts are only known from *Mastixia*, in the *Caesalpinieae* from *Eperna* and *Copaifera*, etc.

Clinton, Maryland

EXPLANATION OF PLATES 206 AND 207.

(All the figures are of *Hamamelis Virginiana* L.)

Plate 206. Fig. 1, leaf of the tree; two-thirds of the natural size. Fig. 2, the seedling; natural size. Fig. 3, second proper leaf of a seedling; natural size. Fig. 4, cross-section of the hypocotyl of a seedling; Ep = epidermis, Co = cork, Coll. = collenchyma; × 480. Fig. 5, cross-section of the primary leaf of a seedling; Ep. = ventral, Ep* = dorsal epidermis, P = ventral chlorenchyma, P* = pneumatic tissue; × 480.

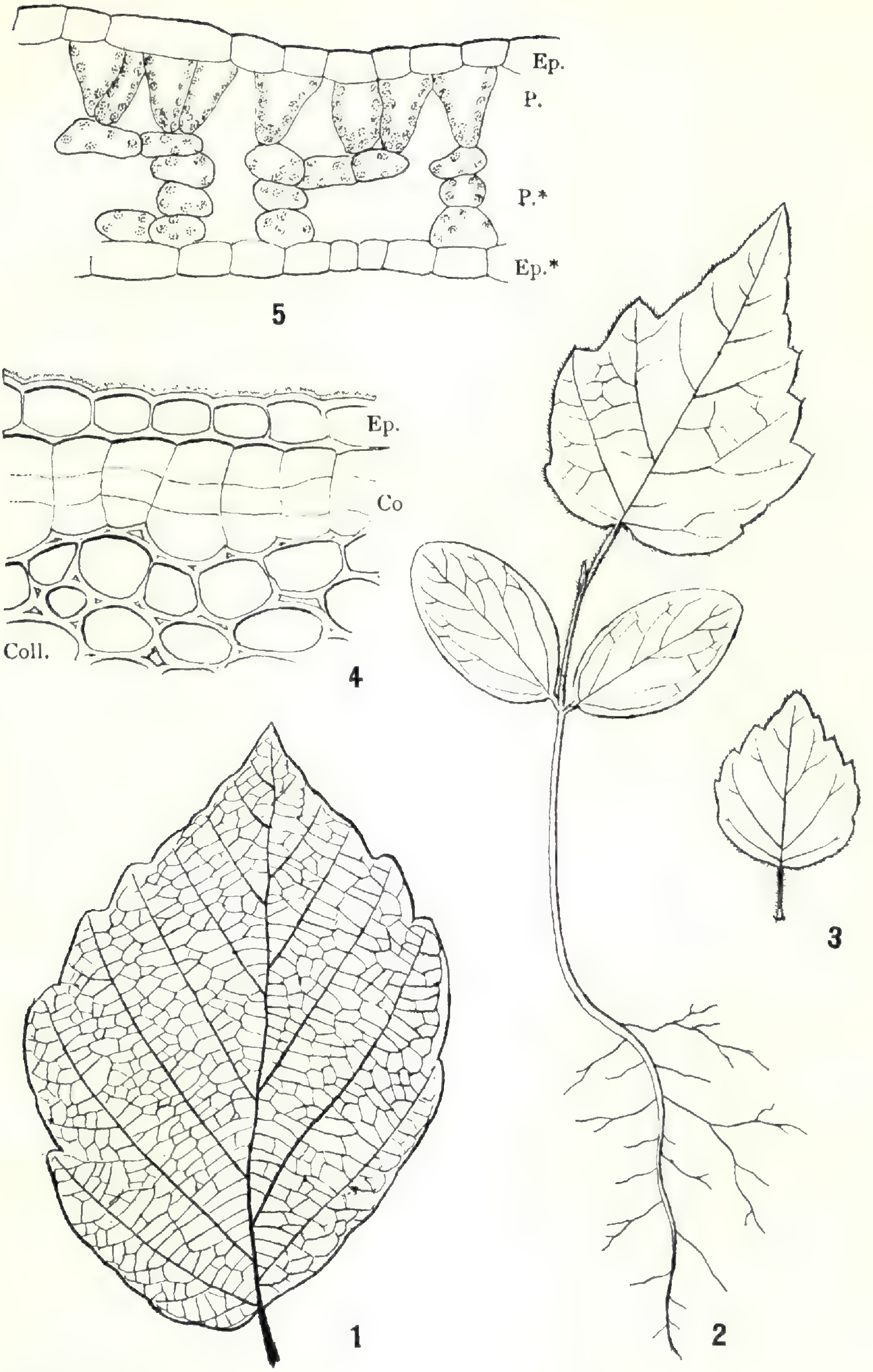
Plate 207. Fig. 6, cross-section of a branch in its first year, letters as in fig. 4; × 480. Fig. 7, cross-section of a leaf of the tree, showing a macrosclereid; letters as in fig. 5; × 480. Fig. 8, cross-section of the midrib of a leaf of the tree, Ep = ventral, Ep* = dorsal epidermis. The large, obtuse keel contains a stele of mestome surrounded by a sheath of stereome, bordering on the leptome, and outside this is a large-celled water-storage-tissue, surrounded by strata of peripheral collenchyma. Above the stele, close to the ventral epidermis, is a small, collateral mestome-strand; × 60.

PECULIAR ASPECTS OF THE NEW ENGLAND DISTRIBUTION OF ARCEUTHOBIUM PUSILLUM

R. J. Eaton

There is a diminutive roadside bog in Concord, Massachusetts, where Thoreau first discovered *Ledum groenlandicum* Oeder seventy-five years ago. Typical associates are also present, such as *Picea mariana* (Mill.) BSP., *Andromeda glaucophylla* Link, *Kalmia polifolia* Wang. and the like.

During a brief stop at this place last summer, Ludlow Griscom called my attention to the diseased appearance of one of the half dozen young specimens of *Picea mariana* which have survived sundry wood cutting and draining operations. On close examination, the disease proved to be a heavy infection of *Arceuthobium pusillum* Peck. Strangely enough we could find no infection on any other spruce despite the fact that the branches of the nearest neighbor were actually interlocked with those of the diseased tree. Thus does the survival of the dwarf mistletoe in this bog, to say nothing of the entire Concord region, hang by a very slender thread!



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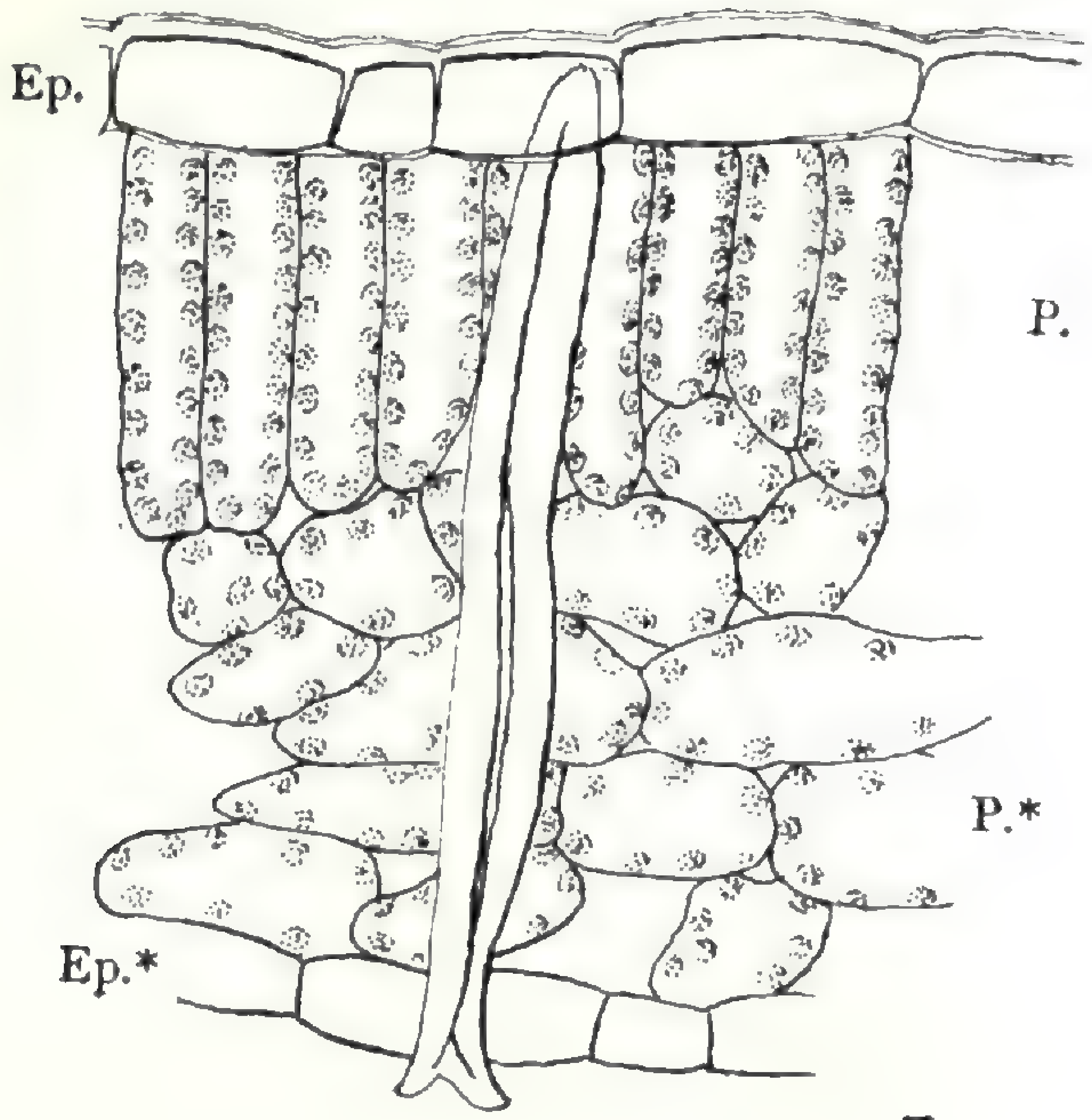
HAMAMELIS VIRGINIANA.



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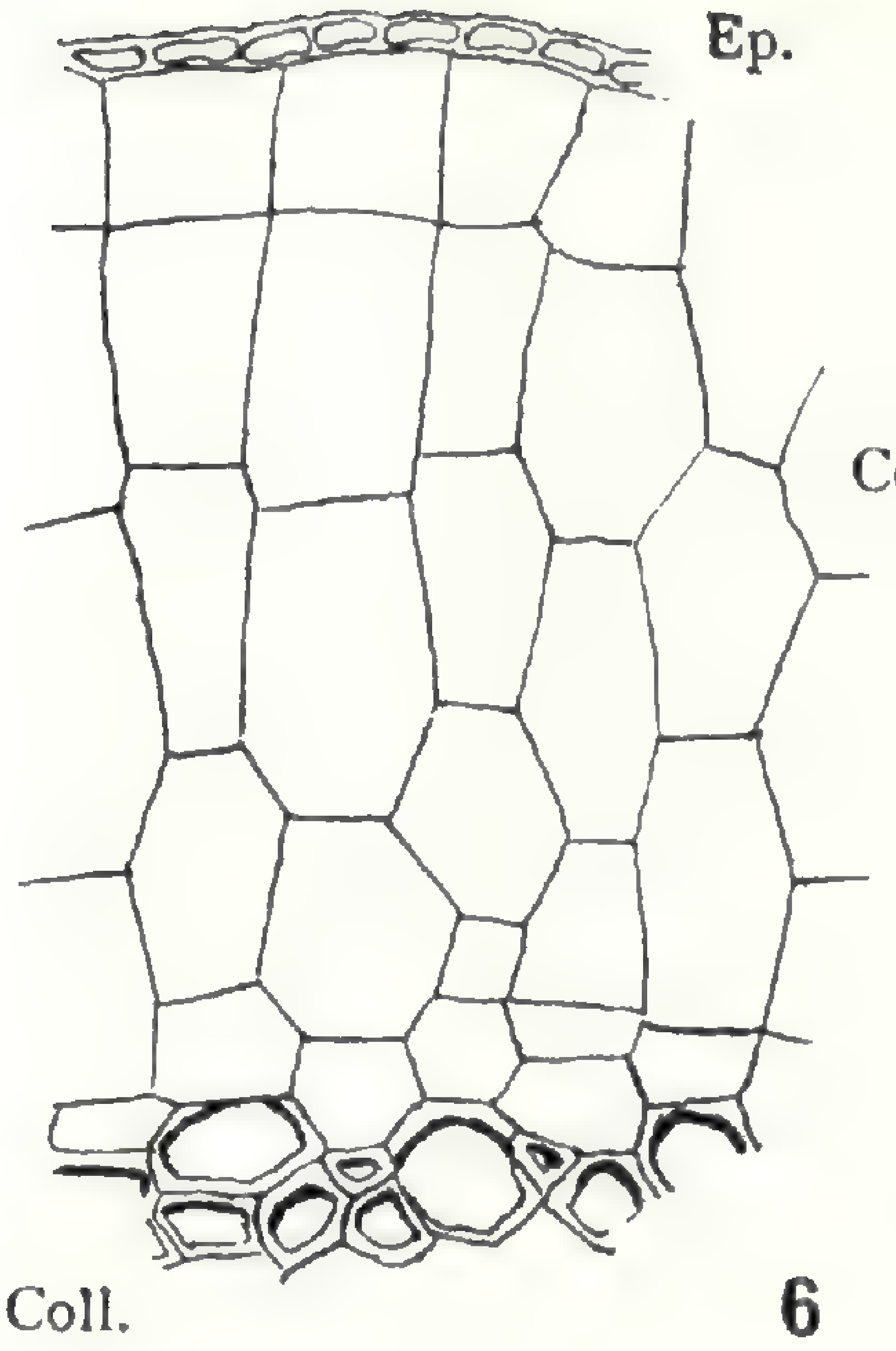

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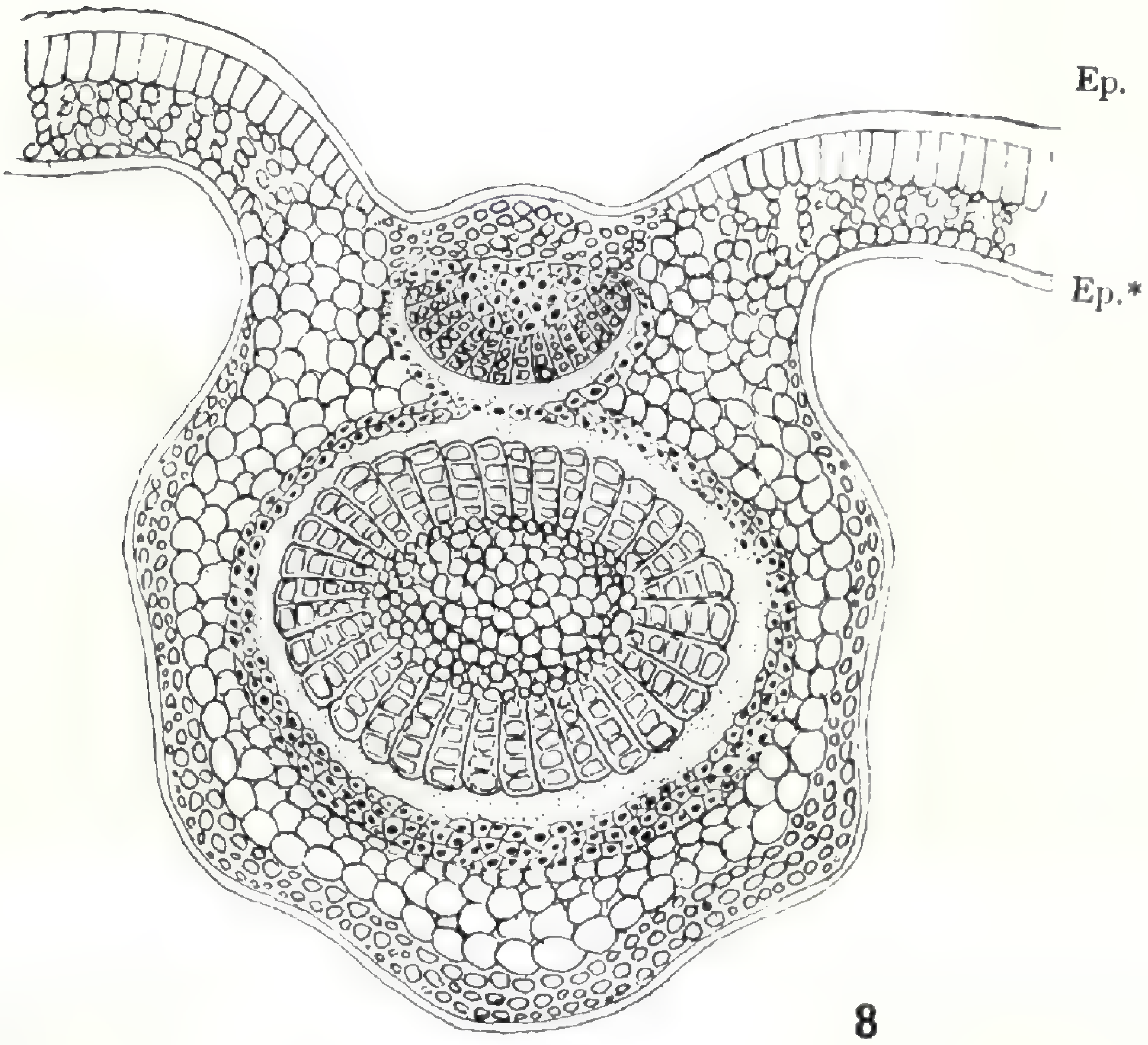

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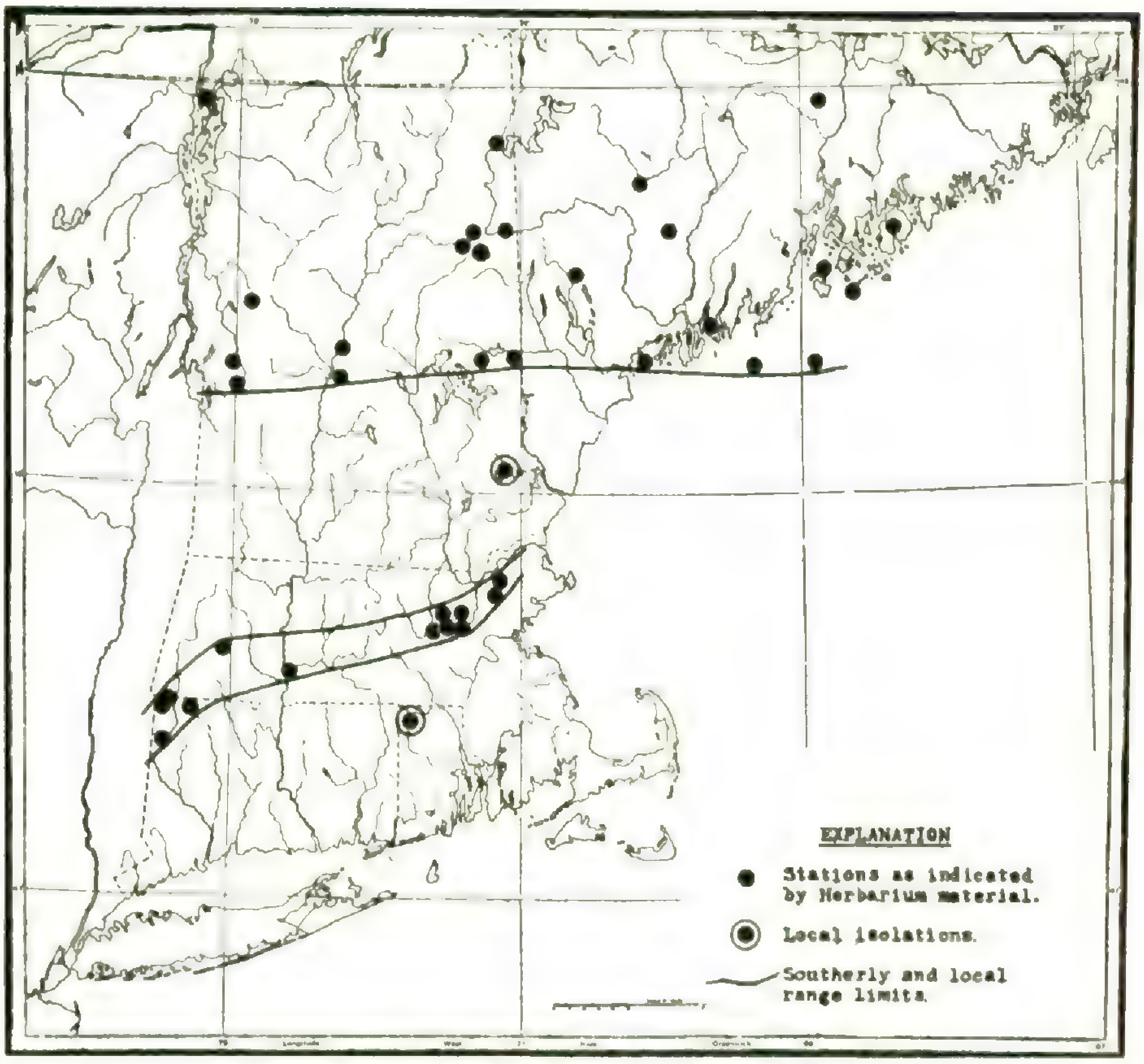
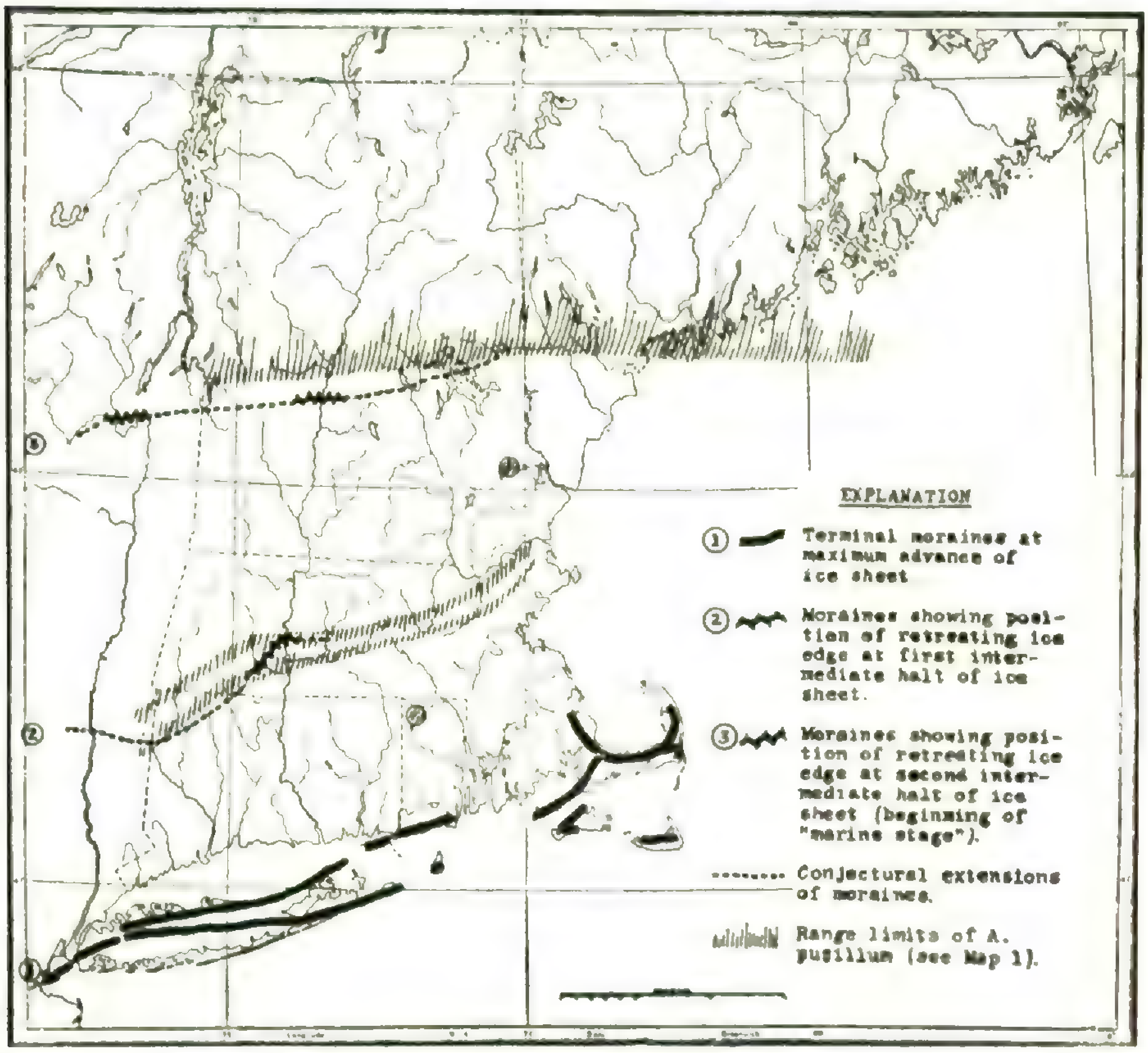
HAMAMELIS VIRGINIANA.

Returning to the bog on September 29, 1930, for fresh material and for further examination of other spruce trees in the vicinity, I collected excellent fruiting specimens, as well as staminate plants, the identity of which has been confirmed by Dr. J. H. Faull. The occurrence of both sexes of this dioecious parasite on a single host tree is exceptional (Thoday & Johnston, Ann. Bot. p. 393, XLIV, April, 1930). Close scrutiny failed to reveal the slightest trace of infection on any other spruce, which is the more surprising in the light of the presence of fertile plants.

An interesting symposium on dwarf mistletoe was published in RHODORA for January, 1900, with excellent plates illustrating the external characteristics of the plant, its effect on the host and the method of seed dissemination. It is astonishing to learn that the parasite was unknown to science prior to 1871. It was considered an extremely rare and local plant as recently as 1899. At present it is regarded as widely distributed throughout the limit of its range, occurring in the six New England states, New York, New Jersey (*L. Griscom*), Pennsylvania, Michigan, Wisconsin, and northward. On the recent authority of Thoday & Johnston (supra), J. H. Faull and others, *A. pusillum* occurs chiefly as an endophytic parasite in the tissues of its principal host, *Picea mariana*, but can spread to *P. canadensis* (Mill.) BSP., *P. rubra* (Du Roi) Dietr., and very exceptionally to *Larix laricina* (Du Roi) Koch. Externally, it appears to be confined to a very definite region of the infected twigs. Full-grown aerial shoots in August with ripening fruits occur mainly on the three-year old stem and occasionally on the upper part of the four-year old stem. Shoots with nearly mature flowers occur on the two-year old twigs. The parasite is not visible as a rule on one-year old or current year growth, although its endophytic system grows forward keeping pace each season with the growth of the host twig. The ovary of the mature plant contains a single ovule covered with a sticky glutinous substance which facilitates transportation by birds and lodgement on a host twig. Faull asserts that germination occurs only on live twigs of the host, and apparently only at particularly favorable spots on the twig. Such a condition indicates that unusual germination factors are necessary for the propagation of the species. This conclusion is of importance in judging the significance of certain observations in subsequent paragraphs of this article.

In view of the fact that *Arceuthobium* is very easily overlooked the





Map 1 (upper). Distribution of *Arceuthobium pusillum* in central and southern New Englamd.

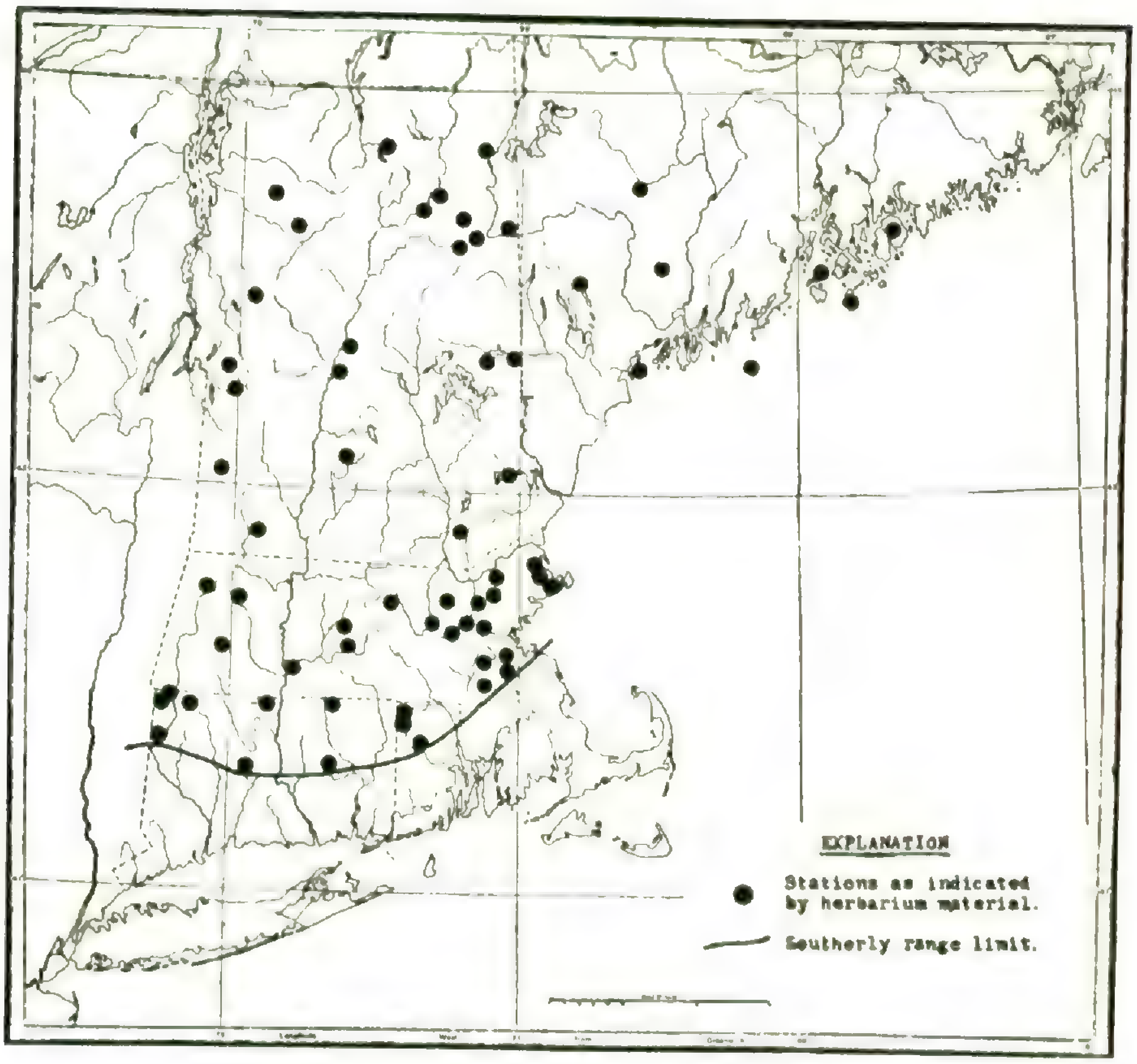
Map 2 (lower). Position of Moraines of the last (Wisconsin) advance of the Pleistocene glaciations (after *Antevs*) compared with southern limits of *A. pusillum.*

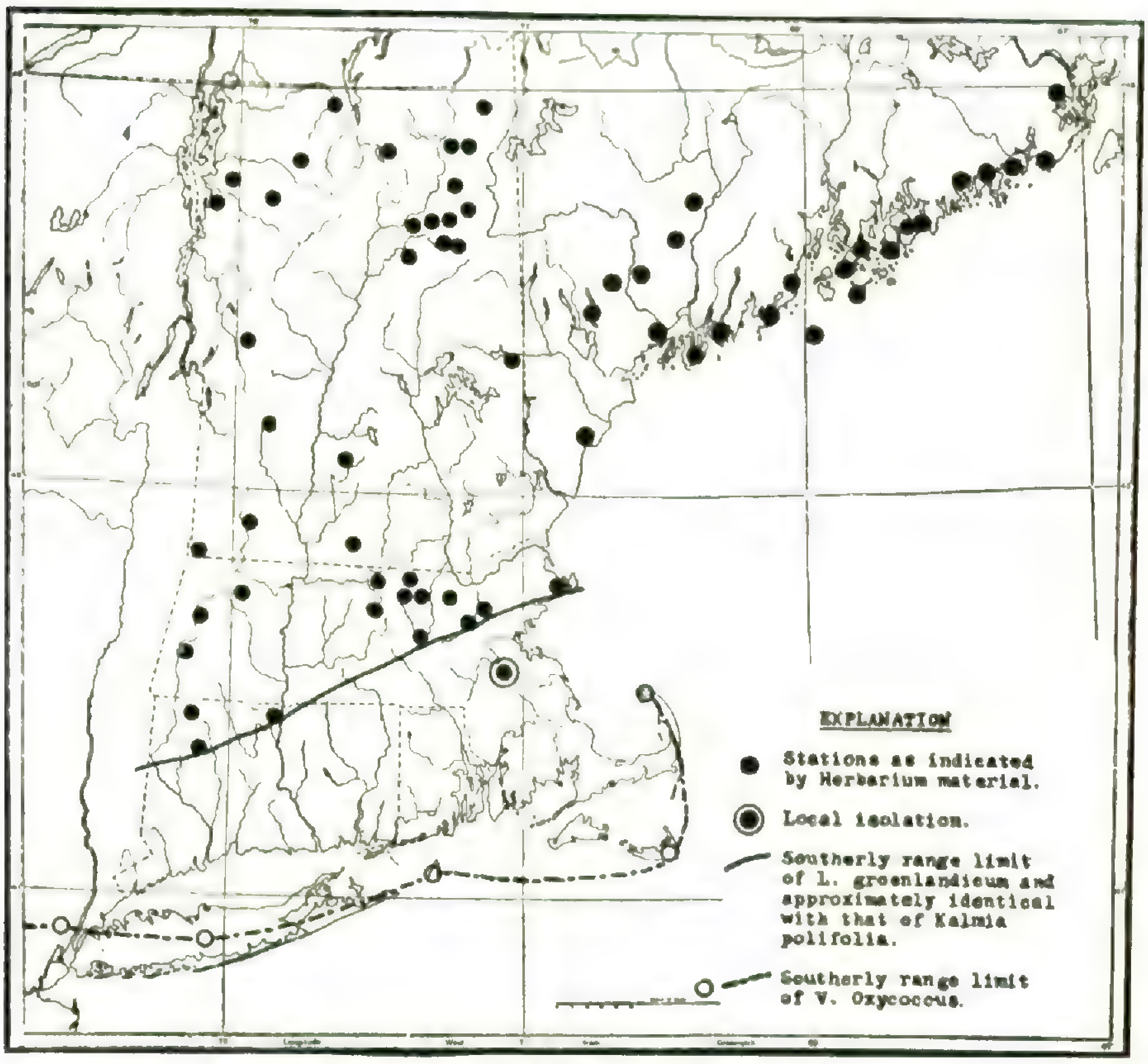
existing records of its occurrence in southern New England, as determined by the specimens filed at the Gray Herbarium, at Arnold Arboretum, and in the herbarium of the New England Botanical Club,[1] perhaps are not particularly significant. The remainder of this article must be read with this clearly in mind. Exclusive of Maine, where the plant is widely distributed, there are collections of dwarf mistletoe from only twenty-eight New England towns (MAP 1). Of these, nine are from Massachusetts, four from Connecticut, and one from Glocester, Rhode Island. Curiously enough, if we consider the Glocester station as a local isolation, the remaining thirteen southern New England stations form a narrow straight belt, closely paralleling and seventy-five miles north of the terminal moraine[2] of the last glaciation. This belt extends from Andover, Massachusetts, to Salisbury, Connecticut, through Wilmington (Massachusetts), Concord, Acton, Lancaster, Clinton, Boylston, Springfield, Becket, Norfolk (Connecticut) and Kent. The new Concord station is the most southeasterly one in Massachusetts. To the northward, there is a wide gap of 80–100 miles from which we have no herbarium material except from a single station at Nottingham, New Hampshire. The most southerly limit of this secondary belt (from present available information) is marked by the line: Matinicus Is. (Maine), Monhegan Is., Great Chebeague Is., Effingham (New Hampshire), Lebanon, Rutland (Vermont).

At the present writing there appears to be no reasonable explanation for this curious representation in the three herbaria consulted other

[1] A thorough analysis of the complete ranges of the plants discussed in this article may not be attempted without reference to all the important herbaria in North America. Lack of time and opportunity prohibits for the present an analysis of the entire North American range of *A. pusillum*, such as I have made for New England. In fact, it is probable that local collections in other sectors of the range are not sufficiently extensive to warrant an attempt at piecing together the whole picture. A continuous series of specimens by townships is the ideal data from which to work up a study of this sort. In all probability the nearest approach to this ideal, as far as any large local area is concerned, may be gained by reference to the New England material contained in the three botanical establishments which I have consulted. The precise distribution of plants within the limits of central and southern New England is sufficiently well known to justify a certain degree of reliance on any conclusions derived from existing records within this area.

[2] Following Antevs (The Last Glaciation, p. 164; Am. Geog. Soc. 1928) I have sketched the three southerly positions of the retreating Wisconsin ice which represent halts of sufficient duration to have produced terminal moraines (MAP 2). It is indeed remarkable that the primary and secondary range-limits of *Arceuthobium* are substantially on the identical lines indicated by Antevs as major intermediate resting stages during the retreat of the ice sheet. No explanation is offered, if indeed any rational explanation is possible.





Map 3 (upper). Distribution of *Picea mariana* in central and southern New England.

Map 4 (lower). Distribution of *Ledum groenlandicum* in central and southern New England (Maine stations incomplete) and the southerly range-limit of *Vaccinium oxycoccus*.

than the merest coincidence. Hence, records accompanied by vouchers from other localities in southern New England would be welcome in order that the true distribution may be determined. However, should it become an established fact that *Arceuthobium* occurs in New England south of 43° 50′ parallel only in an isolated narrow belt (except for the two anomalous outposts previously mentioned at Glocester, Rhode Island, and Effingham, New Hampshire), a problem at once arises which may have subtle ramifications.

Primarily, the distribution of *Arceuthobium pusillum* is determined by that of its two principal hosts, *Picea mariana* and *P. canadensis.* From the meagre evidence in hand, there seem to be striking inconsistencies in the ranges of hosts and parasite. For instance, it is not apparent why *Arceuthobium* should not occur, if indeed such is the case, in the general region, Ashburnham, Ashby, Rindge and Winchendon where *P. mariana* is abundant in the numerous sphagnum bogs of that ill-drained divide between two water-sheds. Again, it is strange that the scattering of spruces in three other sphagnum bogs in Concord should not harbour the parasite, all the obvious ecological conditions being just as satisfactory as at the *Ledum* station.

Some secondary set of influences must operate to restrict the occurrence of *Arceuthobium* to a range strikingly localized in comparison with that of *Picea.* Specimens of black spruce (MAP 3), for example, are noted from twenty-two towns in six counties in Massachusetts, from Ipswich and Foxboro in the east to Adams and Becket in the Berkshires. There are three stations represented from Rhode Island and eight from Connecticut. Its southerly limit of distribution runs through Canton (Massachusetts), Foxboro, Scituate (Rhode Island), Southington (Connecticut) and Kent, for the most part exactly paralleling the limit of range of *Arceuthobium* but about thirty miles to the southward. Obviously, some limiting factors are at work to prevent the dwarf mistletoe from occupying a range essentially coincident with that of black spruce.

There are two curious facts or coincidences concerning *Arceuthobium* which may be suggestive. The first has already been alluded to: at Concord the parasite shows no disposition to spread from the infected spruce to its contiguous neighbor even though the branches of both trees are more or less interwoven. Such a condition at once suggests the remote possibility of a symbiotic association of some sort, although I must confess that the idea is novel to say the least when

applied to vascular parasites. Improbable though it may be, it is not inconceivable that *Arceuthobium* is associated with and perhaps dependent for its complete development on some fungus or bacteria which requires two hosts for the completion of its life cycle. Perhaps the parasite will attack only those individual specimens of spruce and larch which previously for some reason have become weakened. Following out this latter line of thought, it may be found that a small percentage of the host trees are subject to some fungus or other primary disease which permits *Arceuthobium* to gain a foothold. As the southern limit of *Picea* is approached, individual specimens become more and more sparsely distributed in locally isolated bogs. It would follow, logically enough, that the numbers of weakened host trees would diminish and perhaps disappear entirely at the extreme southerly range-limit where stations for spruce are relatively widely separated. By postulating a primary disease to which *P. mariana* is the most and *L. laracina* the least susceptible of the four known hosts of *A. pusillum*, we provide a simple explanation for the extraordinary discrimination which the parasite displays. In this connection, it is pointed out that I found only one specimen of *A. pusillum* on *L. laracina* (Arnold Arboretum: Kent, Connecticut, *Austin & Eames*, 11 May, 1903) among all the material which I examined in the three herbaria despite the fact that the larch is probably just as common as *P. marina*, if not more so, in Massachusetts, Rhode Island and Connecticut.

The second fact relates to an evident similarity in the ranges of *A. pusillum* and certain northern heaths, notably *Kalmia polifolia* and *Ledum groenlandicum*. A detailed range-study of the entire series of the normal sphagnum bog associations, including the cryptogams, should be made before we are justified in attaching much significance to this phenomenon. The occurrence of *Ledum* and *Arceuthobium* in close association in a small bog in Concord along the extreme southeastern limit of range of each species, and nowhere else so far as I know within a radius of approximately eight miles, seemed so curious that I plotted the southern New England distribution of *Ledum* (MAP 4). Except for two locally isolated stations, at Canton, Massachusetts, and Litchfield, Connecticut, and for the *Arceuthobium* station at Glocester, Rhode Island, the southeasterly limits for both species coincide in a most striking fashion. Subsequently, I tested the distribution of four other conspicuous bog plants, in order

to avoid placing undue emphasis solely on *Ledum* as possessing a definite relationship to the occurrence of *Arceuthobium* and *Picea.* The species selected were: *Eriophorum spissum* Fernald, *Kalmia polifolia* Wang., *Andromeda glaucophylla* Link, and *Vaccinium Oxycoccus* L. Of these four random species, the range of *K. polifolia* alone exhibits features comparable to that of *Ledum,* although it occurs much more commonly along its southern limit than either *Arceuthobium* or *Ledum.* Unlike the latter, it is locally isolated at Glocester (Rhode Island) in close association with *Arceuthobium.*

Of the remaining three species, *Eriophorum spissum* occurs at Provincetown (Massachusetts), Glocester (Rhode Island), and Waterbury (Connecticut) as the southern limit of its range, thus bearing no similarity to that of dwarf mistletoe. *Andromeda* exhibits a range comparable to that of *Picea mariana,* from Norfolk County in eastern Massachusetts through Glocester (Rhode Island) to Danbury in southwestern Connecticut. *Vaccinium Oxycoccus* is likely to occur wherever suitable sphagnum bogs exist and is known from Provincetown, Nantucket, Block Island and Ronkonkoma (Long Island, New York) along a line substantially coinciding with the Wisconsin terminal moraine.

The suggestion that *Arceuthobium* may depend in some obscure manner on the presence of *Ledum, Kalmia,* or for that matter any other bog associate, cannot be considered very seriously without much more evidence. Copious as it is, the material examined is too meagre to warrant generalization.[1] A more accurate knowledge of the true ranges, past and present, of the various plants under discussion is

[1] Much emphasis has been laid on mere coincidence resulting from insufficient field data as a probable interpretation of my observations. As a matter of fact, I feel that coincidence is effectually ruled out by the law of chances. Assuming that the distribution of *Picea* is the sole factor in determining that of *Arceuthobium,* except as modified by the less aggressive nature of the latter, owing to limitations of seed dissemination, fecundity, and kindred restrictive influences, one would certainly expect to find scattering stations of *Arceuthobium* throughout the entire range of *Picea mariana* and *P. canadensis.* Because of the insignificant aspect of *Arceuthobium,* we properly might expect a far greater representation of spruce than of dwarf mistletoe in our herbaria, but we also properly would expect to find no essential discrepancies in distribution. The three herbaria contain specimens of *Arceuthobium* from about fifty New England stations and perhaps three times that number of *Picea mariana.* If mere chance is the sole distributional factor the mathematical chances are indeed slim for the fifty *Arceuthobium* stations to fall into two well defined belts which appear to be correlated with several other sets of phenomena: (1) parallelism, (2) range limits of certain bog associations, (3) glacial moraines. Any rational explanation, other than coincidence, is difficult to imagine, considering our present incomplete understanding of the problem. Nevertheless our instinct must prompt us to reject coincidence as altogether too unlikely.

necessary before mere suspicions may become dignified by serious study. My observations are most useful, possibly, as tentative leads for the cryptogamic specialist.

However far-fetched these suspicions may be, it remains true that there are one or more unknown limiting factors in the southerly occurrence of *A. pusillum* which are unrelated to the distribution of its principal host. This fact does not appear to have been pointed out heretofore, and is at present unexplained so far as I am aware. Perhaps microscopic studies of host and parasite will shed some light on the question. I have already alluded to the possible existence of some fungus, requiring two hosts for the completion of its life cycle, which enables the mistletoe to gain a foothold on a previously weakened host tree. It is conceivable also that the parasite may vegetate in a purely endophytic state under certain conditions, awaiting some necessary stimulus for the development of aerial (and visible) shoots capable of reproducing the species. Other wild guesses stimulate the imagination. For instance, on the likely assumption that seed dissemination is accomplished to a certain extent through the agency of birds to whose feet the sticky seed readily adhere, it might be profitable to investigate the casual and permanent fauna and flora of birds' feet, particularly of those species, such as the northern finches, which occasionally winter as far south as southern New England.[1]

It may be significant that another species of the genus *Arceuthobium* presents ecological peculiarities of a baffling nature. An interesting study of the northwestern *A. americanum* Nutt. on *Pinus Banksiana*[2] has been just brought to my attention, fortunately in time to permit a brief allusion to certain points which are pertinent to the present discussion. In this study it is shown that *A. americanum* tends to infect only trees in certain types of habitat, that it is very slow to develop new infections on healthy trees, showing evident preference for trees fifteen years or more old, and that the production of mature fruits in moist situations is very effectually checked by the parasitic

[1] This suggestion is not very helpful in attempting to explain the presence of *Arceuthobium* in the narrow isolated band extending southwesterly across Massachusetts and northwestern Connecticut. Similarly, the fairly regular occurrence of *Ledum* and *Kalmia polifolia* throughout the "gap" in northern Massachusetts, southern Vermont and southern New Hampshire would appear effectually to dispose of any idea that these plants are interdependent. Taking everything into consideration, it does not seem safe to place too much reliance on the supposed gap in the New England distribution of dwarf mistletoe—at least until a more extensive field survey has been made in the barren area.

[2] Dowding, E. S. Ecology of *Arceuthobium americanum* Nutt. Journal of Ecology, XVII. 96–105 (Feb. 1929).

fungus *Wallrothiella arceuthobii* Ros., "a disease which flourishes best in damp shaded places."[3] The present importance of this rests in the fact that *A. pusillum* is a closely related species of the same genus and may be expected to exhibit analogous peculiarities and susceptibilities. Hence, it is all the more probable that the curious distribution of *A. pusillum* in New England points to a problem worthy of the attention of a specialist.

Boston, Massachusetts.

Dwarf Mistletoe and other Plants new to New Jersey.—From 1919 to 1923 the writer had the great good fortune to accompany Mr. Kenneth K. Mackenzie in a long series of summer weekend collecting trips to various parts of New Jersey, and Mr. Mackenzie frequently urged me to record the more unusual and novel finds. We paid particular attention to the higher hills in the northwestern corner of the state in a search for Canadian Zone plants. On June 19, 1920 we explored Pine Swamp, just west of Lake Mashipacong, on the summit of the Kittatinny Ridge in Sussex County, at an altitude of 1200 ft. It proved to be an ideal locality, as there was a quaking sphagnum bog surrounded by black spruce in the heart of the southern end of the swamp. Here were such rarities (for New Jersey) as *Kalmia polifolia* Wang. and *Carex rostrata* Stokes. In the open sphagnum were clumps of *Eriophorum spissum* Fernald (*callithrix* of Gray's Manual), new to the State. The most spectacular event, however, was the discovery of *Arceuthobium pusillum* Peck in some abundance on a considerable number of spruce trees a few minutes after our telling each other that the plant should occur here, if indeed it was ever to be found in the State. The range of the species is here extended south from northwestern Connecticut.

On July 10 the locality was revisited, and we discovered another sphagnum bog in the heart of the north end of the swamp. This bog was a younger one, and contained a small pond in the middle, the border of which was almost unreachable. However, by lying down full length, I was just able to grasp some small clumps of green, equitant leaves, seen from some distance off, which proved to be *Xyris montana* Ries, new to New Jersey. This bog also contained some more *Eriophorum spissum* and a little more Dwarf Mistletoe. Pine Swamp outranks even Budd's Lake as the best of the very few sphagnum bogs in the State.—*Ludlow Griscom*, Cambridge, Mass.

[3] Ibid. 98

A NEW BLACKBERRY FROM NEW HAMPSHIRE

M. L. Fernald

During the summers of 1915 and 1917 I devoted much of my attention to the genus *Rubus* as it occurs in central and northern New Hampshire, collecting and preparing more than 6000 sheets of material, included under 295 numbers. A full series of the more significant species was sent, at his request, to the late Dr. Ezra Brainerd for study. One species in particular, one of the most characteristic trailing or low-arching and entangling brambles of the Pemigewasset Valley in Grafton County, is the subject of this note. In the 1915 collection it was called by Brainerd *R. Groutianus* Blanchard and material under that name was widely distributed; but, convinced by a study of the 1917 collections that it constitutes a distinct species, Brainerd consistently labeled the later collections "*Rubus severus* Brainerd, ined," and under this name I distributed the duplicates.

In Brainerd & Peitersen's *Blackberries of New England—their Classification*,[1] however, published two years later, no recognition was accorded the species, even as a "hybrid," for Brainerd's notes on the sheets in the Gray Herbarium indicate that it might be sought, if not under the new name *R. severus*, at least under *R. elegantulus* or a cross of that and *R. vermontanus*, var. *viridifolius;* Brainerd's labeling in the Gray Herbarium reading: "Revision by Ezra Brainerd. Jan. 1918. *Rubus severus* Brainerd, ined. Combines the characters of *R. elegantulus* Blanch. with those of *R. vermontanus* var. *viridifolius* Blanch." That Brainerd did not comment on this and much other New England material which he had studied in the herbarium may well have been due to a desire first to see the new species growing. Declining strength and advanced years made such an ambition impossible of fulfillment and *R. severus* has lain unpublished until the present time. In view of Brainerd's conviction, expressed in letters as well as on the labels and wholly coinciding with the field-judgment of the collector, that *R. severus* is a distinct species, it seems desirable to give it this belated publication.

Rubus **severus** Brainerd, n. sp. in Gray Herb., arcuans deinde prostratus; turionibus deinde ramosissimis apice radicantibus 0.5–3 m. longis aculeis 2–4 mm. longis rigidis rectis vel curvatis divergentibus vel subretrorsis subulatis basi dilatatis valde armatis, setis glanduliferis sparse intermixtis; foliis quinquefoliolatis longe petiolatis, petiolis

[1] Brainerd & Peitersen, Vt. Agr. Expt. Sta. Bull. 217 (1920).

armatis, foliolis anguste obovatis subcoriaceis acuminatis basi rotundatis glabris vel glabratis petiolulatis supra nigro-viridibus subtus pallidiviridibus grosse duplicato-serratis 4–13 cm. longis 2–8 cm. latis, petiolulis armatis mediis valde elongatis 1.5–4 cm. longis; foliis trifoliolatis subtus minute pilosis glabratisque foliolis elliptico-obovatis 2–7 cm. longis 1–3.5 cm. latis; inflorescentia racemoso-paniculata vel subcorymbiformi foliosa interrupta 0.5–2.3 dm. longa; rhachibus remote retrorse aculeatis minute pilosis; pedicellis filiformibus 2–5 cm. longis aculeis aciculiformibus remotis setis glanduliferis plus minusve intermixtis armatis; sepalis deltoideo-ovatis caudato-acuminatis 4–8 mm. longis; petalis oblongis 9–11 mm. longis 4–5 mm. latis; fructibus globosis; putaminibus semiorbicularibus 2.8–3 mm. longis 1.6–2 mm. latis valde reticulatis.—Pemigewasset Valley, Grafton Co., NEW HAMPSHIRE: dry thickets and borders of woods, Lincoln, July 28, 1917, *Fernald*, no. 15,754; dry thickets and clearings, North Woodstock, Woodstock, August 7, 1915, *Fernald*, no. 11,765; springy thickets and banks, North Woodstock, August 7, 1915, *Fernald*, no. 11,768 (TYPE in Gray Herb.). dry thickets and roadsides, North Woodstock, July 6, 1915, *Fernald*, no. 11,780; river-gravels, North Woodstock, July 6, 1915, *Fernald*, no. 11,782 (all material of 1915 distributed as *R. Groutianus* Blanchard); dry woods and recent clearings, North Woodstock, August 20, 1917, *Fernald*, no. 15,616; border of sphagnous bog, North Woodstock, August 20, 1917, Fernald, no. 15,618; swampy thickets near Lost River, Woodstock, July 31, 1917, *Fernald*, no. 15,752; bushy intervale, Woodstock, August 3, 1917, *Fernald*, no. 15,806; dry thickets, borders of woods and roadsides, Thornton Gore, Thornton, August 27, 1917, *Fernald*, nos. 15,608, 15,745; dry thickets, clearings and roadsides, Thornton Gore, Thornton, July 28, 1917, *Fernald*, no. 15,753.

From *Rubus elegantulus* Blanchard, near which Brainerd seems to have placed *R. severus*, it is at once distinguished by its much more prostrate canes, having much more abundant prickles with occasional gland-tipped setae interspersed; subcoriaceous foliage, with less sharp serration; more prickly and usually glandular-setulose pedicels; smaller flowers; and drupelets with narrower stones. *R elegantulus*, as shown by Blanchard's abundant material, is upright, without glands on young canes or inflorescences; the prickles rather remote; the serration of the membranaceous 5-foliolate leaves very slender and elongate (much as in *R. recurvans* Blanchard); the pedicels more pilose, either unarmed or bristly but not glandular; the petals about 1.5 cm. long, 5–7 mm. broad; the stones of the drupelets broadly ovoid or suborbicular.

Only in its trailing or low-arching habit and its often branching corymbiform inflorescence is *Rubus severus* closely approached by

R. vermontanus, var. *viridifolius*. The latter has acicular, not broad-based and hard, crowded prickles on the much more slender canes; its leaves are thinner and, even in the largest 5-foliolate leaves, the longest petiolule is only 0.7–2.5 cm. long; the longest fruiting pedicels only 2–3 cm. long, more abundantly acerose and glandular-setose.

Rubus Groutianus Blanchard, as shown by the Blanchard material in the Gray Herbarium, differs at once from *R. severus* in its more slender canes with more crowded and strongly recurving arched and more acicular prickles, without intermixed glands; much smaller leaves, the middle petiolule of the 5-foliolate leaves only 0.5–1.5 cm. long; the inflorescence copiously setose, with pedicels at most 1.5–2.5 cm. long; the stones of the drupelets suborbicular or broadly ovate.

Gray Herbarium.

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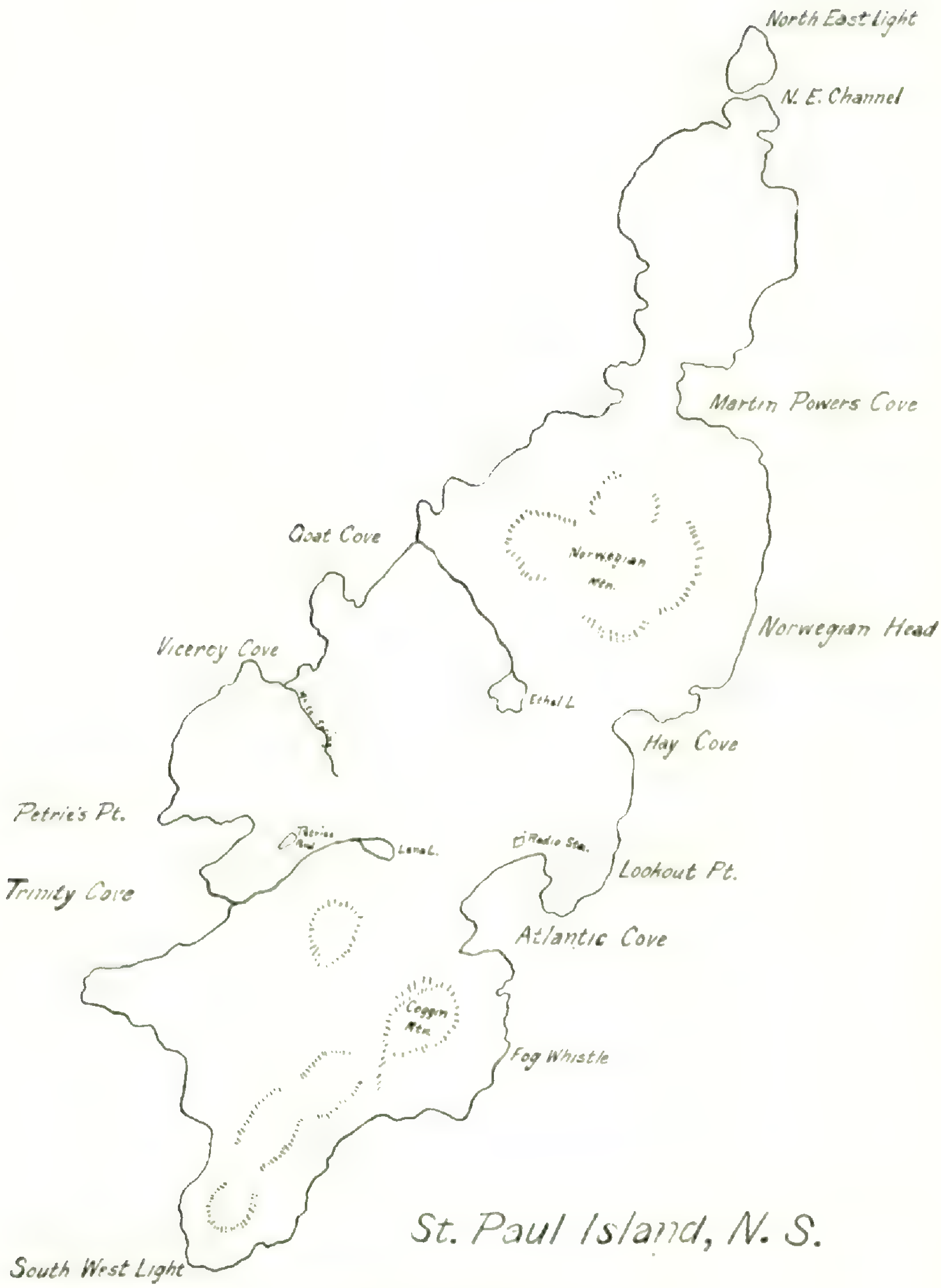
THE VASCULAR FLORA OF ST. PAUL ISLAND, NOVA SCOTIA

Lily M. Perry

St. Paul, one of the smaller islands in the Gulf of St. Lawrence, lies about twelve miles northeast of Cape North, Nova Scotia. It is well-known that at least portions of the Magdalens, Anticosti and the Mingan Islands in the Gulf at some distance from the mainland escaped the Pleistocene denudation and consequently have been of particular interest phytogeographically. Presumably St. Paul also was far enough from the mainland to continue unglaciated, except perhaps locally; if so, its flora too might offer some interesting relics. This possibility and the smallness of the island induced Dr. Muriel V. Roscoe and me to spend a month's vacation there during the summer of 1929 collecting botanical specimens.

It was exceedingly difficult to obtain in advance much information concerning St. Paul. Apart from wireless and the government boats which carry supplies, equipment and employees, there is no regular means of communication with the mainland; no geological survey of the island has been made and consequently no topographic maps are available. Finally, however, Miss Roscoe discovered Miss Campbell, a former resident, who gave us many concrete facts about the place and supplied us with a map which, although drawn with the details of shipwrecks and currents especially for mariners, was invaluable to us in our work.

The island in outline is elliptical-oval, at best not more than a mile wide and approximately four miles long. About a quarter of a mile from the northeast end the sea runs through a narrow channel



MAP OF ST. PAUL ISLAND

so that, in fact, there are really two islands. The part cut off is perhaps a fifth of a mile wide and lacks trees or shrubs of any kind. On it are located the northeast light and the foghorn. A sliding cable with chairlike attachment serves as a means of transportation across the "Tittle" and here one receives as much of a thrill as if riding over the Niagara whirlpool. The island rises rather abruptly from the sea, although the surface is only moderately rolling with two slight elevations, Norwegian and Coggin mountains. On the summit of Coggin Mountain is a small bronze tablet set in concrete and stamped "for information write the Geodetic Survey of Canada." From Mr. Ogilvie, the Director of the Survey, I learned that this tablet is a triangulation station mark of the Geodetic Survey of Canada and its position is as follows: latitude 47° 11′ 40.2″ N., longitude 60° 09′ 06.2″ W., elevation 550 feet above the sea level. This particular station was used not only for the purpose of accurately locating the island and the lighthouses at either end, but also to aid in connecting points in Newfoundland to those in Nova Scotia.

From the economic point of view St. Paul Island is of little value, since for the most part it is covered with a somewhat stunted forest of balsam fir and white spruce. It is really a government station managed by the Department of Marine and Fisheries; and no person, unless shipwrecked, is permitted to land without the consent of the Canadian government. Last summer eight government employees with their families were living there. Although the history of the island will not be considered here, one thing should not be overlooked. Hitherto St. Paul has been a menace to seafaring people on the Gulf of St. Lawrence. The coast is rugged, rocky, irregular and without harbors. There are three or four coves where a stranger might expect to find shelter, but experience has proved them to be more dangerous during a storm than the open sea and the lee side of the island affords the only possible haven. Not only have storms played havoc with vessels but also bewildering fogs and unusually treacherous currents. Practically every little headland has received its name from some ship destroyed thereon. So numerous were the wrecks that, until the year 1924, a life-saving station was maintained on the island under the direction of a governor; and a crew of eight men patrolled the coast every day on the lookout for wrecks or ships in distress. Since that time, however, the Canadian government has established a radio direction-finding station and the operation of this practically elimin-

ates the probability of any large wreck. The operator of any boat or vessel carrying a wireless outfit may ask for and receive his bearing at any time of the day or night.

As early as 1883 we find the island-flora already studied by Dr. A. H. MacKay and his manuscript-list incorporated in Macoun's "Catalogue of Canadian Plants." Nevertheless, so great has been the progress in the field of systematic botany that earlier determinations are often obscure and many times characters have been misinterpreted; for this reason a restudy of the specimens in the light of present knowledge is necessary to establish their identities. For instance, Professor Fernald, while revising the genus *Oxytropis* in eastern North America, found that it had been reported from St. Paul island. Through inquiry, he learned that Dr. MacKay's record had been made on tentative field identification, hence the specimens were unavailable for further study. Since "no *Oxytropis* is known about the Gulf of St. Lawrence except in the Gaspé region and in western Newfoundland (four species)," Professor Fernald emphasized the fact that it was highly desirable to obtain specimens from St. Paul. He also suggested that the flora there would probably reveal significant geographic relationships. Now the scope of the island is too limited to attract outstanding field-botanists; but Miss Roscoe and I believed that here was a somewhat isolated unit whereby we might contribute something to the knowledge of the flora of Nova Scotia and at the same time profit by some valuable field-experience.

It seemed a relatively simple problem to get a boat to transfer us from the mainland to the island; nevertheless, after seeing people there wait ten days for favoring wind, tide and weather in order to go safely ashore, we realized how fortunate we had been to spend only one day at Bay of St. Lawrence. The weather was ideal for tenting and collecting specimens; yet, in spite of almost no fog nor rain, so great was the humidity that it was impossible to dry either specimens or driers out-doors.

In the vicinity of the Radio Station at Atlantic Cove were miniature gardens; and the few fields, at least in part, had been cultivated although not many genera have been introduced. The vegetation of the fields was various. The predominant grasses, *Anthoxanthum*, *Agrostis* and *Phleum*, were associated with a profusion of *Rumex Acetosella, Stellaria graminea, Ranunculus repens, R. acris, Euphrasia canadensis, E. americana, Rhinanthus Crista-galli* var. *fallax, Chrysan-*

themum Leucanthemum var., *Leontodon autumnalis* var. *pratensis, Cirsium arvense* and occasional patches of *Trifolium, Prunella, Galeopsis Tetrahit* var., *Plantago major* and *Centaurea nigra*. In the moister or more meadowy portions *Viola cucullata* and *Arenaria lateriflora* were the showy members of the plant-association. Near the base of one hill *Potentilla canadensis* var. *simplex* was growing with scattering bits of sphagnum. Invariably the dry rocky places were covered with *Sisyrinchium angustifolium, Potentilla tridentata, Vaccinium Vitis-Idaea* var. *minus* and clumps of *Iris versicolor*. Instead of *Spiraea* on the open slopes, *Sanguisorba canadensis* var. *latifolia* grew in abundance. This Alaskan variety has been collected in Quebec at Natashquan and Pontchartrain, and on the island of Anticosti, but apparently has not been known south of Anticosti.

Bordering the swamp of this region was a somewhat solid turf of *Glyceria canadensis, Scirpus rubrotinctus, S. atrocinctus, Eriophorum virginicum, Carex scoparia, Juncus filiformis* and *Luzula campestris* var. *multiflora*. Beyond this the ground was spongy. Usually *Carex stellulata* var. *cephalantha* and *C. paupercula* filled the margins of little "bog-holes." The larger part of the swamp was covered with tussocks of *Scirpus cespitosus* var. *callosus* supplemented in open spots by *Rynchospora alba* and *Epilobium palustre* var. *monticola*. The whole area was interspersed with *Eriophorum angustifolium, Habenaria dilatata, H. fimbriata, Sarracenia purpurea* and a few clumps of *Iris versicolor*. Just beyond in a typical sphagnum bog the inconspicuous *Malaxis unifolia* was growing with an abundance of *Habenaria clavellata* and *Equisetum arvense*, and nearby a scrubby fir concealed a meagre specimen of *Kalmia polifolia*, a species not noted elsewhere on the island.

Owing to zones of dense undergrowth of brushwood, travelling in the forest was exceedingly difficult and in many places well-nigh impossible. Sometimes the scrub was sufficiently compact to carry our weight, but oftener it swallowed us and we had to hunt for a way through. The flora of the woods varied scarcely at all in the different regions. *Athryium angustum*, var. *rubellum, Thelypteris, Phegopteris, T. spinulosa* vars., *Clintonia, Maianthemum, Streptopus, Habenaria obtusata, Coptis, Ribes glandulosum, Aralia nudicaulis, Cornus canadensis, Moneses, Pyrola, Monotropa, Trientalis, Linnaea, Solidago macrophylla, Aster acuminatus* and *Prenanthes trifoliolata* were everywhere. *Empetrum nigrum* or *Chiogenes hispidula* covered the

exposed knolls and *Carex trisperma* carpeted the little swales and glades. Southeast of Lena Lake, *Polypodium virginianum*, *Taxus canadensis*, *Lycopodium lucidulum*, *Mitella nuda*, *Oxalis montana* and *Viola incognita* were frequent. The forest flora, however, was not entirely uninteresting. *Carex crinita* var. *simulans* collected in a swale on the east slope of Coggin Mountain, although known from Newfoundland to Massachusetts chiefly in the mountains, is reported for the first time from Nova Scotia; also *Solidago uniligulata* var. *neglecta* not definitely reported east of Yarmouth county was fairly abundant here. The prevailing tree was *Abies balsamea* although *Picea canadensis* was generally distributed throughout. Possibly an occasional "bog" spruce grew there, but we failed to find any in our cruising. The chief deciduous elements were *Alnus*, *Betula*, *Acer*, *Pyrus*, *Amelanchier*, *Lonicera*, *Viburnum*, and *Sambucus*. These were not plentiful nor were they much larger than undershrubs. *Lonicera canadensis* reaches its northeastern range-limit on St. Paul, and *Amelanchier Fernaldii*, a native of the region about the Gulf of St. Lawrence, is an addition to the Nova Scotian flora

On account of the high winds and salt spray the border of the forest was greatly dwarfed. Often the firs were simply flattened dense mats which grew to the very edge of the sea-cliffs; but, between the woods and the cliffs were also stretches of barren which yielded a variety of interesting things. The barrens were nearly always on headlands and similar in character, although usually each was marked by some species lacking in the others. Here and there in slightly protected places stunted trees weathered the gales, but *Empetrum nigrum* flourished regardless of shelter. Occasionally sprawled with it were *Juniperus horizontalis* and *J. communis* var. *megistocarpa* similar in habit to var. *montana* yet distinguished by larger berries with larger seeds. This variety was described from Sable Island, but it also occurs on the Magdalen Islands and in western Newfoundland. On the broad barren, *Agrostis*, *Ammophila*, *Deschampsia flexuosa*, *Smilacina stellata*, *Iris setosa* var. *canadensis*, *Euphrasia*, *Solidago bicolor* and *Aster novi-belgii* were the general vegetative elements. *Equisetum*, *Agropyron*, *Carex hormathodes*, *C. silicea*, *C. maritima* or *Juncus balticus* var. *littoralis* filled the damp or sphagnous depressions. At the southwest end of the island some two hundred feet above the sea level, *Vaccinium uliginosum* var. *alpinum*, much cropped by the goats, maintained a struggle for existence. Near West Point the boreal

species *Cornus suecica* grew in abundance and close by a colony of *Anaphalis margaritacea* f. *anochlora* prospered. The barren at Trinity Cove was by far the largest, yet its vegetation contained only three particularly interesting things: *Deschampsia flexuosa* var. *montana*, *Rhinanthus groenlandicus* and *Campanula rotundifolia* var. *alaskana*. These natives of Newfoundland and Gaspé are here noted for the first time from Nova Scotia. To this enumeration of boreal species should be added *Silene acaulis* var. *exscapa* (abundant also at the southwest of the island), *Salix Uva-ursi*, *S. cordifolia* var. *callicarpaea* and *Solidago multiradiata*, all collected on a little slope south of the "Tittle" (North East Channel), the two latter the first from south of Newfoundland, Anticosti and Gaspé.

Near the sea cliffs, *Plantago juncoides* var. *decipiens* replaced the *Gramineae*. Along the upper edges of the bluffs were mats of *Cerastium arvense* or *Lathyrus maritimus* and clumps of *Sedum roseum*. At the northeast *Oxytropis johannensis* grew in profusion. This, the only member of the genus known from Nova Scotia, has not been found farther south in Newfoundland than Cape St. George, although it occurs in Quebec, Maine and east along the upper St. John river in New Brunswick. The chief crevice plants were *Puccinellia paupercula* var. *alaskana*, *Festuca rubra* var., *Sagina procumbens*, *Plantago juncoides* var. *decipiens* and *Solidago sempervirens*.

St. Paul rises so abruptly from the sea that it is unsafe to try to reach the water from more than three or four points on the island. Logically enough there is a characteristic lack of beaches. Nevertheless, on the west coast a small sand beach has developed, and in other places below the cliffs sandy margins are appearing. The beach below West Landing maintained a few beach-types: *Mertensia maritima* growing in mats from 6 inches to 2 feet in diameter, *Atriplex maritima* var. *hastata*, *Cakile edentula*, *Polygonum Raii* and *Arenaria peploides* var. *robusta* (a single specimen of each of the last two).

While scouting to obtain the lay of the land, we discovered apparently a low open stretch in the forest northeast of Petrie's Pond. We were eager to explore it, but, since the vegetation of the barren was more mature owing to its exposed location, we bent our efforts in that direction. We started at West Landing and, after following the Trinity Cove barren almost to Petrie's Point, we came to a slight ridge marking a definite change in the plant-association. On the other side of the elevation, a little stream was trickling from a series of

shallow pools and sunken spots of ooze or slimy mud. The locality was too fascinating to resist. From the pools we took *Equisetum arvense* f. *decumbens* and *Triglochin palustre*. We were puzzled by a network of delicate strands on the ooze; however, thinking they were probably indeterminable, we passed them by for species manifestly not yet represented in our collection: *Selaginella selaginoides* nestling under sedge tussocks and tiny banks, *Panicum boreale*, *Danthonia spicata*, *Carex gynocrates* (rare on the island and new to Nova Scotia), *C. Oederi* var. *pumila*, *Thalictrum polygamum*, *Potentilla fruticosa*, *Primula mistassinica* and *Pinguicula vulgaris*. It was impossible to pick up everything that day so we planned to return the following Monday. A heavy rain on Sunday swelled the brooklet and filled the oozy hollows with water. Imagine our surprise to find some pools almost choked with submersed masses of *Utricularia minor*. The specimens were coarser than those of the typical form, the bladders larger and the leaves flattened rather than capillary. There is a form *platyloba* which occurs wherever the plant creeps from the water into a muddy habitat, and I am inclined to believe that our slightly abnormal specimens may be the result of ecological conditions under which they live.

The stream drained a boggy meadow in which grasses and sedges were predominant. Here we gathered *Agrostis hyemalis*, *Calamagrostis canadensis*, *Scirpus cespitosus* var. *callosus*, *S. hudsonianus*, *Eriophorum viridi-carinatum*, *Carex pauciflora*, *C. rostrata* and var. *utriculata*, *Epilobium palustre* var. *monticola*, *Andromeda glaucophylla* and, curiously enough, *Gaultheria procumbens*. Bordering the expanse was a thicket of *Betula pumila*, *Pyrus dumosa*, *Rubus recurvicaulis*, *Rosa nitida*, *Acer rubrum*, *Lonicera villosa* var. *Solonis* and other common types. The swampy and boggy area in one direction was lying adjacent to Petrie's Pond and proved to be the section we had wished to explore. At the opposite end, it opened into a larger bog dotted with a number of small ponds often individual as to floral specialty, usually one of the following: *Sparganium angustifolium*, *Potamogeton epihydrus*, *Lycopodium Selago*, *L. inundatum* or *Juncus canadensis*. Here *Carex Howei*, a coastal plain species, reaches its present northern limit. Just beyond the immediate source of White Spring (the stream draining the bog) a beautiful patch of *Pogonia ophioglossoides* flourished and scattering specimens of *Solidago uniligulata* var. *neglecta* were beginning to blossom.

Apart from the brooklet already mentioned, the streams and their banks were disappointing botanically. This was probably owing to their smallness and the rapidity of the flow of water as well as to the wetness of the land in general. The lakes, Ethel and Lena, were more attractive. In Ethel Lake the wading was good and we added to our list *Isoetes macrospora, Eriocaulon septangulare, Nymphozanthus variegatus, Lysimachia terrestris* and *Lobelia Dortmanna.* The latter is slightly aberrant in that the lip of the corolla is somewhat more coarsely and profusely pubescent than that of the typical form and the protrusion of the pubescence causes the sinuses between the lobes to appear ciliate. Lena Lake was a different proposition. We had been warned to keep away from the lower end if we valued our lives. The muddy bottom, although seemingly solid, had several times given way suddenly, so that it was impossible to ascertain the real depth of water. But alas, here if anywhere ought to be good collecting. The vegetation grew from the margin nearly to the middle of the lake. We visited the place soon after landing and noted that the plants were too immature to collect; incidentally, we discovered by stepping into the water, that good-sized leeches were there in abundance. Just before leaving the island, we went back again to pick up whatever we could without venturing too far from the bank. In three weeks' interval a huge colony of *Scirpus acutus* had grown from a narrow strip along the margin almost to the centre of the lake. We obtained *Potamogeton Oakesianus, Scirpus subterminalis, Carex rostrata* var. *utriculata, Juncus militaris, Utricularia geminiscapa, U. ochroleuca, Aster nemoralis* and var. *major. U. ochroleuca* has been reported in North America only from Greenland; and while this may appear to be a long range-extension, both Professor Fernald and I believe that the specimens (which unfortunately are sterile) compare favorably with authentic material of this species of Hartman in the Gray Herbarium. Petrie's Pond was very small and had a quaking margin from which grew a profusion of *Carex limosa.*

It was our aim to make a complete collection of the vascular flora of St. Paul. Unfortunately, we did not reach a small part of the island, reserved for a last venture since we had been assured that it was almost inaccessible. Four days in advance, we knew that a boat was coming from the mainland for a government official and that we might return with him. By working into the wee small hours of the morning, we had hoped to clear our presses and yet to have left an entire day in

which to pick up at least one specimen of each of the desirable plants of Mica Head, the unexplored region. We had not one day but four so filled with heavy fog that this last field-trip faded into an impossibility. In spite of the lacuna, our collection is fairly representative of the flora of St. Paul. It includes about 2360 sheets of specimens, in all 418 numbers embracing 160 genera and approximately 300 species and varieties. In large part, these are common to the flora of Nova Scotia; some are found only in Cape Breton and St. Paul, while others, 20 in all, were collected in the province for the first time last summer and most of them illustrate definite range-extensions from the north. It is significant that these northern plants are characteristic of slightly or not at all glaciated regions in Newfoundland, Quebec, Anticosti or the Magdalen Islands; hence, if I may draw a parallel conclusion, it seems not unreasonable to infer that St. Paul also escaped denudation by the Wisconsin ice-sheet.

I am under obligation to many people who have aided me throughout my work on the flora of St. Paul Island. First of all, I wish to express my appreciation to Professor Fernald both for suggesting the trip and for the expert assistance and criticism which he has kindly and promptly given from the beginning of our preparation. To Dr. B. L. Robinson, I am deeply grateful for the generous support which made this trip possible, as well as for the personal interest he has shown in the work. I am greatly indebted to all the Canadian government officials and employees who contributed to the success and pleasure of our little expedition. I wish particularly to thank Mr. E. W. Hawken, Assistant Deputy Minister of the Marine Department, and Mr. C. H. Harvey, Agent of Marine and Fisheries at Halifax, for permission to visit the island; Major J. J. McLean, Superintendent of Lighthouses, for shipping our equipment on the "Lady Laurier" and also for many other courtesies; and Mr. H. M. Sutherland, Division Superintendent of Radio, for the special favor of permitting us to board at the Wireless Station. I take much pleasure in thanking Miss Campbell for a map of the island which greatly facilitated our work; and, I am highly appreciative of the helpful and courteous assistance of the government employees during our sojourn on the island. Their spirit of friendliness added much to the enjoyment of our work there.

Vascular Plants collected on St. Paul Island, 1929

In the following list, the names of the species marked * are recorded for the first time, apparently, from Nova Scotia. The introduced species are in italics.

Polypodium virginianum L. Between Atlantic Cove and Lena Lake. Fairly common on the southern half of the island.

Pteridium latiusculum (Desv.) Hieron. Common.

Athyrium angustum (Willd.) Presl. var. rubellum (Gilbert) Butters. Frequent throughout the woods.

Thelypteris Phegopteris (L.) Slosson. Abundant everywhere.

T. noveboracensis (L.) Nieuwl. General in the open woods.

T. spinulosa (O. F. Muell.) Nieuwl., var. intermedia (Muhl.) Nieuwl. Common.

T. spinulosa (O. F. Muell.) Nieuwl., var. americana (Fisch.) Weatherby. Common.

Almost as abundant as the two varieties just mentioned was a form transitional between the two.

Osmunda regalis L., var. spectabilis (Willd.) Gray. Margin of Petrie's Pond and Lena Lake.

O. Claytoniana L. Occasional on the southeast side of the island.

O. cinnamomea L. Frequent in the swampy region of Atlantic Cove.

Equisetum arvense L. Common.

E. arvense L., f. decumbens (Meyer) Klinge. Muddy bottom of stream between Petrie's Pond and White Spring.

E. sylvaticum L., var. pauciramosum Milde. Woods near the Radio Station. Rare in Nova Scotia.

Lycopodium Selago L. By margin of a water-hole in a bog above Petrie's Pond. Rare.

Previously collected in Nova Scotia on the Barrasois River, Cape Breton.

L. lucidulum Michx. General southeast of Lena Lake.

L. inundatum L. Muddy margin of water-hole, bog at head of White Spring.

L. clavatum L. Dry hillock near the path to the North East Light.

Neither this nor the following species were seen elsewhere on the island.

L. obscurum L. Dry hillock near the path to the North East Light.

Selaginella selaginoides (L.) Link. Borders of tussocks; overhanging margins of sluggish stream; between Petrie's Pond and White Spring. Rare.

Isoetes macrospora Dur. Abundant in Ethel Lake.

Not frequent in the province.

Taxus canadensis Willd. General on the southern part of the island.

Picea canadensis (Mill.) BSP. Commonly distributed throughout the forest.

Abies balsamea (L.) Mill., var. phanerolepis Fernald. Everywhere. This rather than the typical form is the predominant tree on the island.

Juniperus communis L., var. megistocarpa Fernald & St. John. Border of forest, Trinity Cove.

Known also on Sable Island, Nova Scotia.

J. communis L., var. montana Ait. Trinity Cove barren. Not plentiful.

J. horizontalis Moench. Common along the west side of St. Paul.

Sparganium chlorocarpum Rydb., var. acaule (Beeby) Fernald. Mud-hole by dam near Atlantic Cove.

S. angustifolium Michx. Miry pond in bog at head of White Spring.

Potamogeton Oakesianus Robbins. Shallow water, Lena Lake.

P. epihydrus Raf. Pond in bog above Petrie's Pond.

Zostera marina L. In wash of tide.

Triglochin maritima L. Stagnant pool in rocks, North East Light.

T. palustris L. Sluggish stream between Petrie's Pond and White Spring.

Panicum boreale Nash. Banks of stream just mentioned.

Anthoxanthum odoratum L. Abundant in all the open places.

Milium effusum L. Woodland, southeast slope of Coggin Mountain.

Oryzopsis asperifolia Michx. Wooded hillsides near Trinity Cove.

Phleum pratense L. Common in abandoned fields.

Agrostis stolonifera L., var. compacta Hartm. Barren slopes.

A. hyemalis (Walt.) BSP. Bog at head of White Spring. The awned form.

A. tenuis × A. stolonifera. [Det. *Dr. M. O. Malte*]. Atlantic Cove.

Calamagrostis Pickeringii Gray. Bog above Petrie's Pond. This grass is rare on the island.

C. canadensis (Michx.) Nutt. Abundant in exposed places. The predominant grass on St. Paul.

Ammophila breviligulata Fernald. Wind-swept barren, Trinity Cove. Not noted elsewhere.

Cinna latifolia (Trev.) Griseb. Woodland between Whistle Point and South West Light.

Deschampsia flexuosa (L.) Trin. General on the barren and in the woods on the west side of the island.

*D. FLEXUOSA (L.) Trin., var. MONTANA (L.) Ledeb. Barren, Trinity Cove.

Var. *montana* is essentially a plant of the northern regions. It is known from Greenland, Labrador, Newfoundland and Quebec (Gaspé and Matane Counties). This is the first collection south of Quebec.

Avena sativa L. Waste places, Atlantic Cove.

DANTHONIA SPICATA (L.) Beauv. Occasional in rocky places.

SPARTINA MICHAUXIANA Hitchcock. Near edge of sea-cliffs, slope southwest of N. E. Channel.

We were very much surprised to find this plant of river banks and other wet habitats growing with *Carex silicea* in a sheltered spot at least fifty feet above the sea level, but evidently it derived sufficient moisture from the drainage of the land above it to thrive.

Poa pratensis L. Occasional, Atlantic Cove.

P. trivialis L. Waste places, Atlantic Cove.

GLYCERIA CANADENSIS (Michx.) Trin. Border of swamp, Atlantic Cove.

PUCCINELLIA PAUPERCULA (Holm) Fernald & Weatherby, var. ALASKANA (Scribn. & Merr.) Fernald & Weatherby. Crevices of rocks, North East Light.

FESTUCA RUBRA L. Rocky slopes, North East Light.

*FESTUCA RUBRA L., var. ARENARIA (Osbeck) Fries. With *F. rubra.*

Var. *arenaria* is another native of northern lands; it has been collected previously in Greenland, Newfoundland and Quebec (Matane and Gaspé Counties).

F. RUBRA L., var. JUNCEA (Hack.) Richter. Crevices of cliffs, Trinity Cove.

Agropyron repens (L.) Beauv. Waste places.

*A. CANINUM (L.) Beauv., var. HORNEMANNI (Koch) Pease & Moore. Barren, Trinity Cove.

Var. *Hornemanni* has been reported as far south as the alpine region of New Hanpshire, but I have not found anything to indicate that it has been collected previously in Nova Scotia.

ELEOCHARIS PALUSTRIS (L.) R. & S., var. MAJOR Sonder. Near the margin of Lena Lake. Scarce.

SCIRPUS CESPITOSUS L., var. CALLOSUS Bigel. Common in bogs.

S. HUDSONIANUS (Michx.) Fernald. Peat bog between Petrie's Pond and White Spring. Only a few patches seen.

S. SUBTERMINALIS Torr. Shallow water, Lena Lake.

S. ACUTUS Muhl. Petrie's Pond and Lena Lake.

S. RUBROTINCTUS Fernald. General in swampy land.

S. ATROCINCTUS Fernald. Swamp, Atlantic Cove.

Eriophorum angustifolium Roth. General in bogs and swamps.

E. viridi-carinatum (Engelm.) Fernald. Occasional in bogs.

E. virginicum L. Abundant in swamp, Atlantic Cove.

Rynchospora alba (L.) Vahl. Bogs.

Carex hormathodes Fernald. Wet hollow in barren, Trinity Cove.

C. Howei Mackenzie. Peat bog at head of White Spring.

This is a southern species which as yet has not been found farther north.

C. scoparia Schkuhr. Common.

C. silicea Olney. Barren near the edge of the sea cliffs.

*C. gynocrates Wormsk. Bog between Petrie's Pond and White Spring. Rare.

C. exilis Dewey. Sphagnous margin of Petrie's Pond.

C. stellulata Good., var. cephalantha (Bailey) Fernald. Common.

C. interior Bailey. Peat bog at head of White Spring.

C. brunnescens Poir., var. sphaerostachya (Tuckerm.) Kükenth. Frequent in the open woods.

C. trisperma Dewey. Wet mossy fir woods near Lena Lake.

C. stipata Muhl. Occasional in swales.

C. maritima O. F. Muell. Swales on barren, also in muddy pockets in rocks.

C. crinita Lam., var. gynandra (Schwein.) Schwein. & Torr. Swamp in woods near the Radio Station.

*C. crinita Lam., var. simulans Fernald. Woodland, Coggin Mountain.

C. Goodenowii Gay. Profuse everywhere.

C. pauciflora Lightf. Bog above Petrie's Pond.

C. Buxbaumii Wahlenb. Swamp near Petrie's Pond.

C. novae-angliae Schwein. Norwegian Head.

C. paupercula Michx. Common in swampy regions.

C. limosa L. Floating out from the margin of Petrie's Pond.

C. Oederi Retz., var. pumila (Coss. & Germ.) Fernald. Occasional in hollows on the barren or near the sea cliffs.

C. arctata Boott. Occurring casually in the open woodland.

C. debilis Michx., var. Rudgei Bailey. Swampy woods near the Radio Station.

C. intumescens Rudge. By streamlet from the dam near the Radio Station.

C. rostrata Stokes. Swamp near Petrie's Pond.

C. rostrata Stokes, var. utriculata (Boott) Bailey. Shallow water, Lena Lake.

Eriocaulon septangulare With. Ethel Lake.

Juncus bufonius L. Abundant everywhere on open spots.

J. tenuis Willd. Common along paths.

J. balticus Willd., var. littoralis Engelm. Windswept barren, Trinity Cove southwest.

J. filiformis L. Swale, Atlantic Cove.

J. effusus L., var. solutus Fernald & Wiegand. Margin of Lena Lake.

J. effusus L., var. compactus Lej. & Court. Frequent.

J. brevicaudatus (Engelm.) Fernald. Abundant between Lena Lake and Petrie's Pond.

J. canadensis J. Gay. Peat bog at head of White Spring. Rare.

J. militaris Bigel. Shallow water, Lena Lake.

J. articulatus L. Common in open places.

J. articulatus L., var. obtusatus Engelm. Wet path toward the North East Light.

Luzula saltuensis Fernald. Norwegian Head.

L. campestris (L.) DC., var. multiflora (Ehrh.) Čelak. Common in fields.

*L. campestris (L.) DC. var. comosa (Meyer) Fernald & Wiegand. Woodland path near Lena Lake.

This variety, generally distributed from Montana west and northwest, has been collected in eastern America, in western Newfoundland and at one station in Gaspé County, Quebec.

Clintonia borealis (Ait.) Raf. Abundant throughout the woods.

Smilacina stellata (L.) Desf. Common on the barrens.

Maianthemum canadense Desf. General in the forest.

Streptopus amplexifolius (L.) DC. Frequent at the southwest end of the island.

S. roseus Michx. Fairly well distributed throughout the woodland.

Iris versicolor L. In swamps and on dry rocky places.

I. setosa Pall., var. canadensis Foster. Near the cliffs on headlands and barrens.

Sisyrinchium angustifolium Mill. Common.

Habenaria dilatata (Pursh) Gray. Usual in bogs.

H. clavellata (Michx.) Spreng. Sphagnum bog, Atlantic Cove.

H. obtusata (Pursh) Richardson. Everywhere in the woods.

H. fimbriata (Ait.) R. Br. Fields bordering the woodland.

Pogonia ophioglossoides (L.) Ker. Growing in profusion, peat bog at head of White Spring.

Calopogon pulchellus (Sw.) R. Br. Occasional in bogs and swamps.

Listera cordata (L.) R. Br. Damp woods near Lena Lake.

Malaxis unifolia Michx. Sphagnum bog, Atlantic Cove.

*Salix Uva-ursi Pursh. Wind-swept barren southwest of N. E. Channel.

Although this species ranges farther south on the alpine summits of New England and New York, probably this locality is the southern limit of its growth near the sea-level.

*S. cordifolia Pursh, var. callicarpaea (Trautv.) Fernald. (Prostrate). Barren at the north end of the main island.

"Var. *callicarpaea* is common from northern Labrador to northwestern Newfoundland and the Shickshock Mountains, Quebec".

Myrica caroliniensis Mill. Bogs. Scarce.

Betula papyrifera Marsh. Infrequent, but general.

B. pumila L. Bogs. Casual.

This species has been collected by Nichols in Cape Breton but it is not commonly distributed through the province.

Alnus crispa (Ait.) Pursh, var. mollis Fernald. Fairly common.

*Geocaulon lividum (Richardson) Fernald. Barren near Petrie's Pond.

Rumex crispus L. Abundant in old fields.

R. obtusifolius L. Interspersed with the last named species.

R. Acetosella L. Apparently profuse in the fields and occasional on the barrens.

Polygonum aviculare L. Atlantic Cove. Weed.

P. Persicaria L. Atlantic Cove. Weed.

P. scabrum Moench. Atlantic Cove. Weed.

P. Raii Babington. Sand beach beyond West Landing. Only one plant seen.

Chenopodium album L. Occasional on hillsides.

Atriplex patula L., var. hastata (L.) Gray. Sand beach beyond West Landing. Scarce.

Spergularia leiosperma (Kindberg) F. Schmidt. Grassy slope, North East Light.

Sagina procumbens L. The characteristic plant of rock crevices.

Arenaria lateriflora L. Wet grass-land, Atlantic Cove.

Stellaria borealis Bigel., var. floribunda Fernald. Between West Landing and South West Light. Rare.

S. graminea L. Common in fields.

S. media (L.) Cyrill. Waste places.

Cerastium arvense L. Edge of cliffs, Trinity Cove.

C. vulgatum L. Old cellar, Trinity Cove.

*Silene acaulis L., var. exscapa (All.) DC. Abundant at the southwest end of the island, also south of N. E. Channel practically at sea level.

This is the first record near sea level southwest of Newfoundland.

Nymphozanthus variegatus (Engelm.) Fernald. Ethel Lake.

Nymphaea odorata Ait., var. rosea Pursh. Petrie's Pond and Læna Lake.

Ranunculus Cymbalaria Pursh. Grassy slope, North East Light.

R. acris L. Abundant in fields.

R. repens L. Vying with the last named species in profusion.

Thalictrum polygamum Muhl. General, variable; on rolling slopes up to 1 m. high, in bogs as small as 3 dm. in height.

COPTIS GROENLANDICA (Oed.) Fernald. Common in the forest.

ACTAEA RUBRA (Ait.) Willd. Open woods at the foot of Coggin Mountain. Not seen elsewhere on the island.

Thlaspi arvense L. Between West Landing and South West Light.

Capsella Bursa-pastoris (L.) Medic. Weed, Atlantic Cove.

CAKILE EDENTULA (Bigel.) Hook. On cliffs and sand beach.

Brassica juncea (L.) Cosson. Weed near the Radio Station.

B. arvensis (L.) Ktze. Waste places.

SARRACENIA PURPUREA L. Plentiful in bogs.

DROSERA ROTUNDIFOLIA L. Abundant in open spots.

SEDUM ROSEUM (L.) Scop. Common on cliffs and rocky knolls.

MITELLA NUDA L. Deep woods south east of Lena Lake. General.

RIBES GLANDULOSUM Grauer. Frequent on the southern part of the island.

R. HIRTELLUM Michx. Generally distributed but casual.

PYRUS ARBUTIFOLIA (L.) L. f., var. ATROPURPUREA (Britt.) Robinson. Rocky margins of the lakes.

*× P. ARSENII (Britton) Arsène. (*P. arbutifolia* var. *atropurpurea* × *P. dumosa*). Frequent.

P. DUMOSA (Greene) Fernald. Thicket bordering bog above Petrie's Pond.

*AMELANCHIER FERNALDII Wiegand. Margin of Ethel Lake.

The species thus far is restricted in its distribution to the Gulf of St. Lawrence region. It has been collected on the Magdalens, Anticosti, Quebec (along the lower St. Lawrence), Newfoundland and, now, St. Paul.

A. BARTRAMIANA (Tausch.) Roemer. Between Ethel Lake and Atlantic Cove.

FRAGARIA VIRGINIANA Duchesne, var. TERRAE-NOVAE (Rydb.) Fernald & Wiegand. By the dam near the Radio Station. General.

POTENTILLA NORVEGICA L., var. HIRSUTA (Michx.) Lehm. Near the Radio Station. Not noted elsewhere.

P. CANADENSIS L. var. SIMPLEX (Michx.) T. & G. Wet slope, Atlantic Cove.

P. PACIFICA Howell. Rocky slopes and near margins of cliffs.

P. TRIDENTATA Ait. Rocky places. Common.

P. FRUTICOSA L. Bogs.

RUBUS IDAEUS L., var. CANADENSIS Richardson. Occasional in the woods.

R. CHAMAEMORUS L. Fairly general in bogs.

R. PUBESCENS Raf. Abundant in the open places.

R. RECURVICAULIS Blanchard. Peat bog at head of White Spring. Rare.

*SANGUISORBA CANADENSIS L., var. LATIFOLIA Hook. Frequent on grassy slopes.

An Alaskan variety heretofore known in the east only from the

north shore of the St. Lawrence River (two stations), Quebec and the island of Anticosti.

Rosa nitida Willd. Casual in boggy places.

Prunus pennsylvanica L. f. Top of Coggin Mountain, also between Lena Lake and Petrie's Pond. Rare on the island.

Trifolium pratense L. Fields.

T. repens L. Near edge of cliffs, Money Rocks.

*Oxytropis johannensis Fernald. Abundant at the northeast end of St. Paul.

Although this species has not been collected in Newfoundland south of Cape St. George, its range extends south from Quebec into Maine and east along the upper St. John River in New Brunswick. This is undoubtedly the plant reported in Macoun's Catalogue (i. 115) from St. Paul as *O. uralensis*, var. *pumila*, and later (i. 509) as *O. arctica.*

Vicia angustifolia (L.) Reichard, var. *segetalis* (Thuillier) Koch. Weed, Atlantic Cove.

Lathyrus maritimus (L.) Bigel. Border of cliffs, Trinity Cove.

L. palustris L., var. macranthus (T. G. White) Fernald. Grassy slope, North East Light.

Although found in Nova Scotia, it is more plentiful farther north.

Oxalis montana Raf. Common in the forest of the southern half of the island.

Empetrum nigrum L. Very abundant in all the open habitats.

Ilex verticillata (L.) Gray. Occasional in bogs.

Nemopanthus mucronata (L.) Trel. Bog south east of Lena Lake.

Acer spicatum Lam. Woodland between Lena Lake and West Landing.

A. rubrum L. Thicket bordering the bog above Petrie's Pond. None of the specimens seen were larger than shrubs.

Hypericum canadense L. Path, near Lena Lake. Scarce.

Viola cucullata Ait., f. prionosepala (Greene) Brainerd. Fields.

V. pallens (Banks) Brainerd. Sphagnous depressions on barren, also in the forest. General.

V. incognita Brainerd. Deep woods southeast of Lena Lake.

Epilobium angustifolium L. Atlantic Cove.

E. glandulosum Lehm., var. adenocaulon (Haussk.) Fernald. Open woods, Atlantic Cove.

E. palustre L., var. monticola Hausskn. Common in bogs.

Oenothera perennis L. Waste places, Atlantic Cove.

Circaea alpina L. Dripping slope of open woods, Coggin Mountain.

Aralia nudicaulis L. A characteristic woodland species.

Carum Carvi L. Weed, Atlantic Cove.

Ligusticum scothicum L. Rocky slopes usually near the cliffs.

Heracleum lanatum Michx. Swale, Coggin Mountain.

CONIOSELINUM CHINENSE (L.) BSP. Fairly general on the island, but apparently not so in the province.

*CORNUS SUECICA L. Sphagnous depression in barren, Trinity Cove southwest.

This boreal species occurs in Greenland, Newfoundland, Quebec, Anticosti, the Magdalens, St. Paul and Alaska. After collecting several sheets of the material at Trinity Cove, Miss Roscoe and I noticed near Martin Power's Cove an abundance of *Cornus*, the berries of which were very like this species but the leaves were much larger. In passing we thought it *C. suecica*, but I now believe it was rather *C. canadensis* var. *intermedia* Farr. However, since we took no specimens, I cannot make this statement with surety.

C. CANADENSIS L. Common.

MONESES UNIFLORA (L.) Gray. Common in the woods.

PYROLA CHLORANTHA Sw. Woodland near Lena Lake.

P. SECUNDA L. Casual in the woods.

MONOTROPA UNIFLORA L. Frequent.

LEDUM GROENLANDICUM Oeder. Well distributed but not anywhere abundant.

KALMIA ANGUSTIFOLIA L. Chiefly at Atlantic Cove.

K. POLIFOLIA Wang. Sphagnum bog, Atlantic Cove. Not seen elsewhere.

ANDROMEDA GLAUCOPHYLLA Link. Bog above Petrie's Pond. Scarce.

CHAMAEDAPHNE CALYCULATA (L.) Moench. Bog on the left of the path to North East Light.

GAULTHERIA PROCUMBENS L. Bog above Petrie's Pond.

CHIOGENES HISPIDULA (L.) T. & G. Abundant on knolls in open woodland.

GAYLUSSACIA DUMOSA (Andr.) T. & G., var. BIGELOVIANA Fernald. Bog on the left of the path to North East Light.

VACCINIUM VITIS-IDAEA L., var. MINUS Lodd. Frequent.

*V. OXYCOCCUS L., var. INTERMEDIUM Gray. Near cliffs, Lookout Point.

V. PENNSYLVANICUM Lam. Woods, Atlantic Cove. Rare.

V. ULIGINOSUM L., var. ALPINUM Bigel. Upper slope of headland, West Point; South West Light.

Previously collected by Nichols on the mountains west of Ingonish, but not generally distributed in Nova Scotia.

PRIMULA MISTASSINICA Michx. Banks of streamlet between Petrie's Pond and White Spring.

LYSIMACHIA TERRESTRIS (L.) BSP. Shallow water, Ethel Lake.

TRIENTALIS BOREALIS Raf. Common in the forest.

GLAUX MARITIMA L., var. OBTUSIFOLIA Fernald. Rocky slope, North East Light.

Halenia deflexa (Sm.) Griseb. Hillside, Martin Power's Cove.

This species is listed by Nichols (Vegetation of Northern Cape Breton, 324, 1918) as common on bleak exposed headlands. I do not find any other record of its occurrence in the province.

Menyanthes trifoliata L., var. minor Michx. Stagnant pools and bogs.

Convolvulus sepium L., var. pubescens (Gray) Fernald. Atlantic Cove.

Mertensia maritima (L.) S. F. Gray. Sand beach beyond West Landing.

Prunella vulgaris L., var. lanceolata (Barton) Fernald. Fields, Atlantic Cove.

Galeopsis Tetrahit L., var. *bifida* (Boenn.) Lej. & Court. Waste places, Atlantic Cove.

Lycopus uniflorus Michx. Open places. Infrequent.

Veronica serpyllifolia L. By streamlet, Hay Cove.

Euphrasia purpurea Reeks, var. Randii (Rob.) Fernald & Wiegand. Hillside, Martin Power's Cove. Abundant.

E. purpurea Reeks, var. Randii (Rob.) Fernald & Wiegand, f. albiflora Fernald & Wiegand. Hillside, Martin Power's Cove.

E. purpurea Reeks, var. Farlowii (Rob.) Fernald & Wiegand. Barrens.

E. americana Wettst. Field, Atlantic Cove. Frequent.

E. canadensis Townsend. Field, Atlantic Cove. Abundant.

*Rhinanthus groenlandicus Chabert. Near ruins of an old house, Trinity Cove. Not noted elsewhere on the barren.

This boreal species is represented in the Gray Herbarium by specimens from Greenland, Labrador, western Newfoundland, Quebec (Saguenay Co.), Anticosti, the Mingan Islands and Alaska.

R. Crista-galli L., var. fallax (Wimmer & Grab.) Druce. Abundant in fields, Atlantic Cove.

Utricularia geminiscapa Benj. Lena Lake.

U. minor L. Pools of streamlet between Petrie's Pond and White Spring.

The specimens differ from those of the typical form in having bladders somewhat larger than usual and flattened rather than terete leaves. Possibly they correspond to f. *platyloba* Meister, which is merely the result of an ecological reaction to creeping out on the mud.

*U. ochroleuca R. Hartm. Lena Lake.

This dainty little plant is most closely related to *U. intermedia*, which ordinarily may be identified by the fact that the bladders are borne on separate leafless branches. *U. ochroleuca*, too, has separate

bladder-bearing leafless branches, but it differs from its relative in bearing bladders also on the leaves of the immersed stems; moreover, the teeth along the margins of the leaves are larger than those characteristic of *U. intermedia.* Unfortunately our specimens are sterile, but Glück intimates that sterility is not an unusual occurrence in this species. *U. ochroleuca* is fairly common in the northern countries of Europe. It has been reported from two localities in Greenland, but this is the first record south of there; hence, it is not only an addition to the flora of Nova Scotia but also to that of Canada.

PINGUICULA VULGARIS L. Banks of streamlet between Petrie's Pond and White Spring.

Found also on Cape Breton, but not elsewhere in the province.

PLANTAGO JUNCOIDES Lam. toward var. LAURENTIANA Fernald. Rocks, North East Light.

P. JUNCOIDES Lam., var. GLAUCA (Hornem.) Fernald. Hillside, Martin Power's Cove.

P. JUNCOIDES Lam., var. DECIPIENS (Barneoud) Fernald. Barrens. Common.

P. MAJOR L. Field, Atlantic Cove.

GALIUM TRIFLORUM Michx. Woods near the Radio Station.

G. CLAYTONI Michx. Common in swamps and wet open places.

MITCHELLA REPENS L. Near the outlet of Lena Lake.

LONICERA VILLOSA (Michx.) R. & S., var. SOLONIS (Eaton) Fernald. Margin of peat bog at head of White Spring.

L. CANADENSIS Marsh. Woods near Ethel Lake.

This is the northeastern limit of its range.

LINNAEA BOREALIS L., var. AMERICANA (Forbes) Rehder. Abundant in the forest.

VIBURNUM CASSINOIDES L. Casual on the southern part of the island.

SAMBUCUS RACEMOSA L. Open places in the woodland.

CAMPANULA ROTUNDIFOLIA L. Hillside, Martin Power's Cove. In this locality we found one white-flowered form. The typical was abundant near cliffs.

*C. ROTUNDIFOLIA L., var. ALASKANA Gray. Rocky slopes.

This Alaskan variety has been collected east of British Columbia only in western Newfoundland and Gaspé (one collection), and, now, St. Paul (Nova Scotia).

LOBELIA DORTMANNA L. Ethel Lake.

The specimens differ slightly from the typical in the more pubescent lip of the corolla.

SOLIDAGO BICOLOR L. Rocky slope above South West Light.

S. macrophylla Pursh. Open forest. Fairly common.

S. puberula Nutt. Woodland near Martin Power's Cove.

*S. multiradiata Ait. Barren southwest of N. E. Channel.

Distributed in the west from Manitoba to Alaska. In the east, reported from western Newfoundland and Quebec (Gaspé and Matane counties).

S. sempervirens L. Both near and on cliffs.

S. uniligulata (DC.) Porter, var. neglecta (T. & G.) Fernald. Peat bog at the head of White Spring.

S. rugosa Mill., var. sphagnophila Graves. Wet gulch, Norwegian Mountain.

Aster lateriflorus (L.) Britton. Woods, Atlantic Cove.

A. radula Ait. Swamp, Atlantic Cove. Part of the specimens collected approach var. strictus.

A. novi-belgii L. Casual on the barren.

A. umbellatus Mill. General in open places.

A. acuminatus Michx. Open woodland.

A. nemoralis Ait. Margin of Lena Lake.

A. nemoralis Ait., var. major Peck. Margin of Lena Lake, growing with the typical form.

Anaphalis margaritacea (L.) B. & H. Hillside, Atlantic Cove.

A. margaritacea (L.) B. & H., f. anochlora Fernald. Barren, Trinity Cove southwest.

Gnaphalium uliginosum L. Waste places, Atlantic Cove.

Achillea Millefolium L. Clearing near South West Light.

Matricaria suaveolens (Pursh) Buchenau. Hillside, Atlantic Cove.

Chrysanthemum Leucanthemum L., var. *pinnatifidum* Lecoq & Lamotte. Abundant in the fields, Atlantic Cove.

Cirsium muticum Michx. Casual. Only three or four specimens seen.

C. arvense (L.) Scop. Swale, base of Norwegian Mountain.

Centaurea nigra L. Field, Atlantic Cove.

Leontodon autumnalis L., var. *pratensis* (Link) Koch. Weed, Atlantic Cove.

Taraxacum officinale Weber. Atlantic Cove.

Prenanthes trifoliolata (Cass.) Fernald. In open forest and along borders. Common.

P. trifoliolata (Cass.) Fernald, var. nana (Bigel.) Fernald. Barren, Trinity Cove.

Gray Herbarium.

THE ALGAE OF ST. PAUL ISLAND[1]

Muriel V. Roscoe

(Plate 208)

While on a month's expedition to St. Paul Island with Miss Lily Perry during the summer of 1929, the writer undertook to make a collection of the marine algae. Very little attention has been given to the algal flora of the Canadian regions and the idea is current that it is of little interest. That of St. Paul revealed more of variety than would perhaps be anticipated.

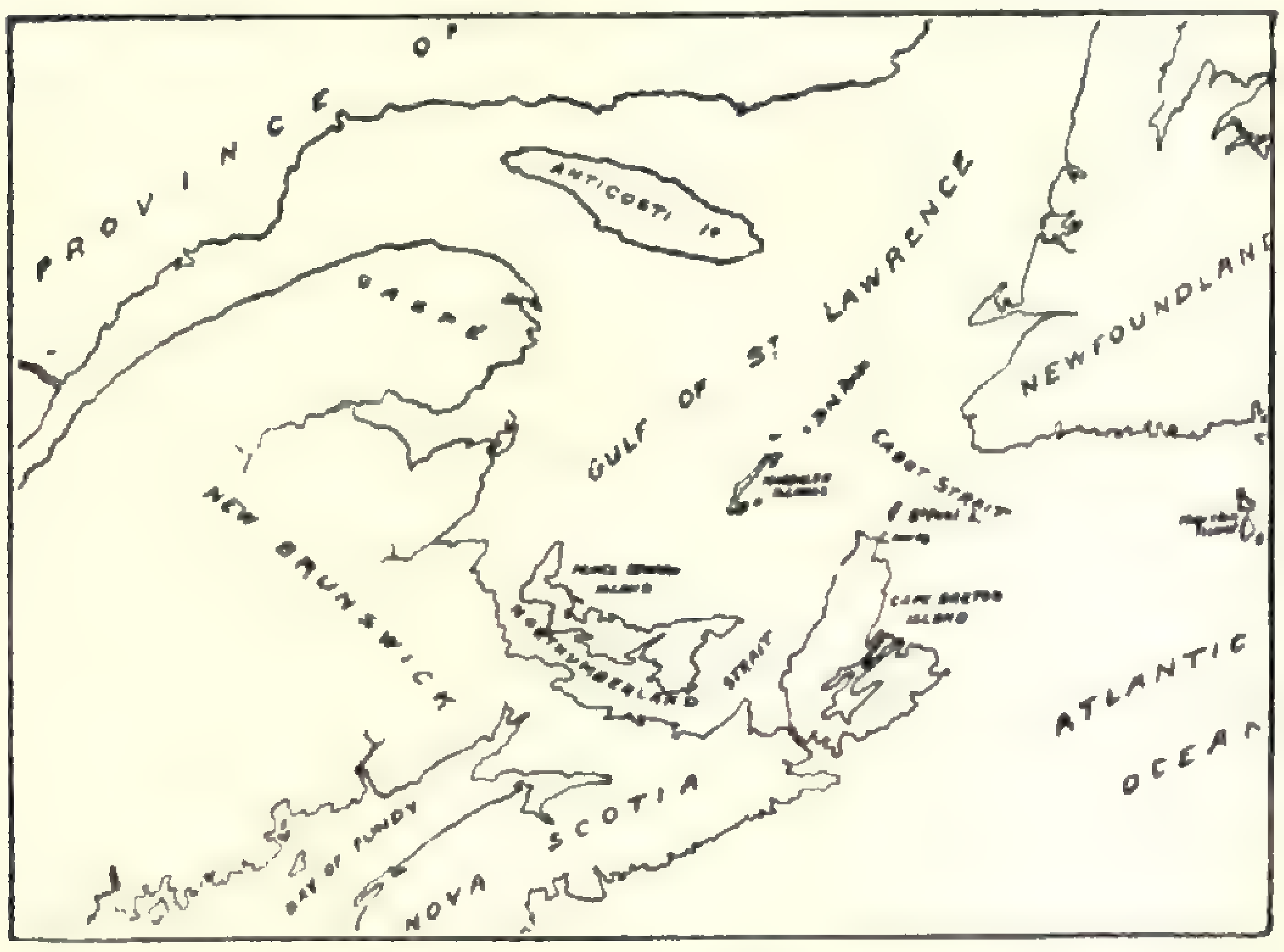


Fig. 1 (left). Gulf of St. Lawrence, showing location of St. Paul Island (in Cabot Strait). Fig. 2 (right). St. Paul Island.

St. Paul is a small island lying in Cabot Strait some twelve miles north-east of Cape North, the most advanced outpost of Nova Scotia (fig. 1). It is about fifty miles distant from Cape Ray, the nearest Newfoundland point. Since it lies in the pathway not only of all boats passing up the St. Lawrence from southern ports, but also of European liners at those seasons when the Strait of Belle Isle is not a feasible route, this island has acquired much importance in navigation. From the earliest history of St. Lawrence shipping it has proved a menace to ocean traffic. Thus, very early, the Canadian Government established two light-houses on the island as well as a fog alarm and a well-equipped life-station. In 1924 the latter was replaced by a direction-finding station.

With an extreme length of no more than four miles and a width

[1] Contribution from the Department of Botany, Acadia University.

which varies from one-half a mile to a mile, the island has no claim to size. It rises abruptly from the ocean bed from depths of about 250 fathoms. The shore line is characterized by formidable cliffs which rise perpendicularly to heights varying between 50 and 100 or even 150 feet. These form in general an insurmountable barrier to land approach. West Landing in Trinity Bay and the Boat Landing in Atlantic Cove are exceptions (fig. 2).

The entire island is rough and bold, with the highest of its hills, Mt. Coggin, reaching a height of 550 feet. Perched high above sea-level and shut in among the hills are two bodies of water known as Ethel Lake and Lena Lake. Streams forming outlets from the lakes are surprisingly small. Thus the main outlet of Ethel Lake leading to the west side of the island was found to be, even at its source, little more than a foot in width. A second outlet, the tiniest of streamlets, drained eastward and eventually trickled over the rocky precipice at Kay Cove. As a whole, natural drainage of the island is slight and the water for the most part is retained in the soil which is a thin, superficial covering over the huge rock. It was thus an anomaly to find an island with such steep inclines and an abundant supply of water and yet with so little opportunity for its escape.

The island suffers all the rigors of climate which its location would suggest. Dense fogs, high winds and severe winter storms are its lot. During the winter months, the drift ice of the St. Lawrence very effectively shuts it off from communication with the mainland. This pan ice is in cakes about six feet in thickness. Its effect upon the algae is conjectural, but doubtless it quite effectively scours off and removes at least the intertidal zone forms.

The temperature of the surface waters in these regions ranges from 55 to 65 degrees fahrenheit in summer.[1] Since the St. Paul spring tides are but four feet high and the neaps but three feet,[2] the exposure of algae at low tide is not great. There is an outward current from the Gulf which is here known as the Cape Breton Current and which attains a speed varying between ½ knot and 1½ knots an hour.[3]

Once arrived, it was apparent to us that the algae would be relatively inaccessible. In the absence of a boat, it was necessary to confine most of the collecting to two regions, Trinity Cove (at West Landing)

[1] The Currents in the Gulf of St. Lawrence. Dept. of Naval Service. Ottawa. 1913.

[2] Tide Tables for the Eastern Coasts of Canada for the year 1929. Dept. of Marine and Fisheries. Ottawa.

[3] The Currents in the Gulf of St. Lawrence. Dept. of Naval Service. Ottawa. 1913.

and Atlantic Cove (at Money Rocks and the Boat Landing). A third region, on the west side of Martin Power's Cove, did not add anything to the collection made at the former points. A fourth collecting ground was the salt spray pools in the rocks at the North East Light. These slightly saline pools are at least 100 feet above the sea, and receive from the sea only the spray thrown up during very high storms. They yielded a rich growth of *Enteromorpha intestinalis* and also abundant mats of *Rhizoclonium tortuosum* and *R. riparium,* the latter a species not found elsewhere during the month.

It is apparent that the collections do not necessarily represent an inclusive list of the marine algae of the island. And yet, since the accessible regions were also in the most protected areas, it is felt probable that few forms escaped detection.

The most favorable place for algal growth on the entire shore appeared to be at Money Rocks (PL. 208, FIGS. 1 and 2). Here the large rocks project outward into the water in a gradual enough fashion to enable collecting to be done at low tide both from the outer rocks and in the inner tide pools. On the outer rocks, an abundance of *Scytosiphon* and *Chordaria* plants were clinging to the exposed faces. In the inner pools, several species of greens such as *Chaetomorpha Melagonium, Enteromorpha intestinalis* and *Rhizoclonium tortuosum* formed dense growths. In the outer deep channels, through which constantly surged even at low tide the strongest of currents, the hardy kelps found a favorable location.

Money Rocks, fortunately, is directly in front of the Direction Finding Station (PL. 208, FIG. 2) and since this was our headquarters for pressing and drying operations the proximity of the collecting ground was an asset. Collecting was expediated because confined to a small area. It was however rendered both difficult and hazardous by the roughness of the coast, the precipitousness of the rocks and even in the most favorable places by the strength of the local currents and the force of the waves.

Although the Money Rocks region was considered the best for variety of forms, the greatest abundance of any species observed was at the Atlantic Cove Boat Landing, where great quantities of *Chordaria* formed dense coverings over all the rocks. By far the best *Alaria* and *Laminaria* specimens were secured here in the wash after a heavy storm, and along with these were splendid specimens of *Agarum.* Since one expects *Fucus* and *Ascophyllum* in cold northern waters, the lack of any abundant growth of these was striking.

The only fresh water forms collected belong to the genus *Batrachospermum*. The abundance of *B. vagum* in Ethel Lake, where it formed a dense growth over the rocks in shallow water, calls for special comment. Also, a second species, *B. moniliforme*, was discovered in the streamlet draining into Kay Cove.

In all, some thirty-nine species and varieties have been identified as follows:

Chaetomorpha Melagonium forma rupincola Aresch.
Cladophora flexuosa (Griff.) Harvey
Cladophora rupestris (L.) Kützing
Enteromorpha intestinalis (L.) Grev.
Rhizoclonium riparium (Roth) Harvey
Rhizoclonium tortuosum Kuetz.
Spongomorpha arcta (Dillw.) Kützing

Agarum Turneri Post. & Rupr.
Alaria esculenta (L.) Grev.
Ascophyllum nodosum (L.) Le Jolis
Chorda Filum (L.) Stack.
Chordaria flagelliformis (Fl. Dan.) Ag.
Desmarestia viridis (Fl. Dan.) Lamour.
Dictyosiphon hispidus Kjellm.
Dictyosiphon foeniculaceus var. americanus Collins
Elachistea fucicola (Velley) Fries
Fucus filiformis Gmelin

Fucus vesiculosus L.
Fucus vesiculosus var. laterifructus Grev.
Fucus vesiculosus var. sphaerocarpus J. Ag.
Laminaria digitata (L.) Lamour.
Laminaria saccharina (L.) Lamour.
Leathesia difformis (L.) Aresch.
Pylaiella littoralis (L.) Kjellm.
Sacchoriza dermatodea (De la Pyl.) J. Ag.
Scytosiphon lomentarius (Lyng.) J. Ag.

Ahnfeltia plicata (Huds.) Fries
Batrachospermum moniliforme Roth
Batrachospermum vagum (Roth) Ag.
Ceramium rubrum (Huds.) Ag.
Chondrus crispus (L.) Stack.
Corallina officinalis L.
Halosaccion ramentaceum (L.) J. Ag.
Phymatolithon compactum (Kjellm.) Fosl.
Polysiphonia urceolata (Lightf.) Grev.
Polysiphonia violacea (Roth) Grev.

Ptilota pectinata (Gunner) Kjellm.
Rhodomela subfusca (Woodw.) Ag.
Rhodymenia palmata (L.) Grev.

In addition to *Spongomorpha arcta* of usual size and appearance from the rocks at the Boat Landing, some specimens with filaments 100–150 micra broad and 7–8 cm. long were obtained in the wash at Money Rocks. The *Rhodomela subfusca* was not altogether characteristic. Howe indicates that "it leans a little toward the variety *gracilior.*" It was not anticipated that any *Polysiphonia* would appear in the region. Although not abundant, the specimens of *P. urceolata* and *P. violacea* denote that the genus is at least represented.

I am grateful to Dr. W. R. Taylor for checking the collection and for his assistance in identifying some of the more difficult species. I am indebted also to Dr. Marshall A. Howe for final determination of species of *Phymatolithon, Spongomorpha* and *Rhodomela.*

Acadia University,
Wolfville, Nova Scotia.

Another Station for Panicum calliphyllum Ashe.—On July 29, 1928 I accompanied Mr. Clarence H. Knowlton in a short botanizing trip around East Weymouth, Massachusetts, one of several trips that summer, where I benefited greatly by his expert guidance. One of the areas explored was composed of innumerable tongues of salt meadow, from which rose steep little wooded ridges, with a distinctly richer, less sandy soil than the prevalent type along the South Shore. On one of these steep hillsides in dense shade, we happened to notice a good sized patch of a large *Panicum,* which struck us as not being "quite right" either in appearance or habitat for *P. clandestinum,* and after some discussion as to what it might be, specimens were collected on general principles. That night while putting the day's collection in press, I was surprised to be quite unable to "key" the grass in either Gray's Manual or Britton and Brown. One day last spring I brought a package of such puzzles to the Gray Herbarium, where, however, my labors were shortened by the kindly interest of Professor Fernald, who with his usual acumen named it offhand as *Panicum calliphyllum.*

This species of *Panicum* has been collected on a very few occasions only, Ontario, once; Ohio, once; central New York, once or perhaps

twice; eastern Massachusetts (Medford, West Roxbury, and Lakeville, Plymouth Co.). This scattered and peculiar distribution is strikingly like that of a small group of relict species discussed by Fernald (Amer. Journ. of Botany, vol. 5, 1918, p. 225), of which *Cyperus Engelmanni* is one.

In a very difficult and "finely split" genus, it is a refreshingly distinct species. Technically its affinities are with the rare and local *P. Bicknellii*, but the spikelets are longer (3mm.) and the blades wider (up to 12 mm.). In the field, however, it would be passed over nine times out of ten for *P. clandestinum*, because of its large spikelets, unless it was being specially sought for. It may be separated in the field from *P. clandestinum* on the following counts: (1) the blades average distinctly narrower; (2) the plant is bright (almost yellowish) green instead of dull grayish green, a difference noticeable in properly dried specimens; (3) the sheaths are never swollen, and absolutely smooth; (4) the panicle is few-flowered, consisting of a few, stiff, ascending branches, whereas in *P. clandestinum*, the branches are long and flexuous; (5) the spikelets tend to be long-pedicelled, instead of on short peduncles.

A duplicate sheet has been given to the Gray Herbarium, my no. 12430.—*Ludlow Griscom*, Cambridge, Mass.

Volume 33, no. 388, including pages 81 to 104 and plates 206 and 207, was issued 10 April, 1931.

Figs. 1 and 2. Money Rocks, St. Paul Island

Finlay Bot Lab

Rhodora

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JOURNAL OF

THE NEW ENGLAND BOTANICAL CLUB

Vol. 33. **June, 1931.** **No. 390.**

AN OVERLOOKED SPECIES OF CORAL-ROOT FROM THE ROCKY MOUNTAINS

C. E. Hellmayr and K. J. Hellmayr

Through the kind coöperation of Dr. Aven Nelson we were enabled to visit, in the summer of 1929, the Medicine Bow Range, Wyoming. On one of our excursions in search of orchids we came across several scattered colonies of a Coral-root which we immediately recognized as different from any other species known to us. Studies in the Rocky Mountain Herbarium of the University of Wyoming (Laramie) revealed the fact that the plant had heretofore been referred to the European *Corallorrhiza trifida* Chat., a species with which we are thoroughly familiar in nature and which we had collected in large numbers the year before in Germany and Switzerland.[1] Prof. T. D. A. Cockerell[2] apparently was the first to notice its distinctness from the Old World plant, but in the absence of European material, he had to rely on published descriptions, and provisionally separated the Colorado form as a subspecies under the name *C. corallorhiza coloradensis.* The differences between the two plants are, however, such as to suggest specific distinctness.

The Rocky Mountain plant may, accordingly, be described as:

Corallorrhiza **wyomingensis**, n. sp., caulibus gracilibus 10–16 cm. altis, infra medium 2 vel rare 3 bracteis vaginantibus onustis; floribus in racemum laxum 9–12-florum dispositis; bracteis minutis triangularibus obtusis; ovario pedicellato torto perianthio erecto longiore; planta tota pallide lutea, floribus laete luteis, labello albo; sepalis lateralibus lineari-lanceolatis plus minusve patentibus et juxta labellum deflexis, 6–7 mm. longis; sepalis superioribus brevioribus

[1] This summer (1930) we again had an opportunity of studying numerous fresh plants in the Bavarian Alps.

[2] Torreya, xvi, 1916, p. 231.

latioribusque supra columnam productis; petalis breviter subacutis vel obtusis ca. 5 mm. longis et 1.5 mm. latis sepalis superioribus paullo brevioribus; labello late oblongo basi angustato apice truncato, parte apicali deflexa et undulato-marginata; lobis lateralibus minutis dentiformibus; calcare obsoleto vel obscuro; columna longiuscula et gracili prope medium attenuata prorsum valde curvata; clinandrio leviter scrobiculiformi minuto.

Stem slender, 10 to 16 cm. high with two, rarely three, sheathing scales on basal half; flowering spike a loose raceme of from 9 to 16 flowers; bracts minute, triangular, obtuse; ovary pedicelled, twisted, longer than the erect perianth; whole plant light yellow, flowers brighter, the lip pure white; lateral sepals linear-lanceolate, somewhat spreading and deflected at sides of lip, 6 to 7 mm. long; upper sepals shorter and broader, roofing over the column; petals briefly subacute or obtuse, about 5 mm. long and 1.5 mm. wide, slightly shorter than upper sepals; lip broad-oblong, narrowed at base, truncate at tip, with apical half deflexed and wavy-edged; lateral lobes exceedingly small, tooth-like; no trace of a spur, at best suggested by a faint swelling; column fairly long and slender, attenuated in the middle, strongly bent forward; clinandrium a small, slight depression.

Type from Libby Creek (alt. 7000 ft.), near Libby Lodge, Medicine Bow Range, Wyoming, July 17, 1929 (*C. E. and K. J. Hellmayr*, No. 72).

Geographical Distribution.—Rocky Mountains, Wyoming: Libby Creek, near Libby Lodge (*C. E. and K. J. Hellmayr*, July 17, 1929); Jackson Creek (July 7; Rocky Mountain Herbarium, University of Wyoming); Horse Creek, seven miles west of Merna, Sublette County (July 16, 1922; Rocky Mountain Herbarium).

C. wyomingensis is nearly related to *Corallorrhiza trifida;* but the flowers are markedly larger, the column is slenderer and more strongly curved, and the lateral lobes of the lip, so conspicuous in its ally, are barely suggested. Besides, the coloration is quite different, the entire plant being light yellow, with the wholly unmarked lip in abrupt contrast pure white. *Corallorrhiza trifida* is purplish or brownish green, the sepals and petals are tipped with purplish, and the trilobed lip is dotted or streaked with bright purple, this color also encroaching on the top of the column. Twenty-five specimens of *C. wyomingensis* examined on the spot were perfectly alike in coloring and did not show any variation. In the majority, there was no trace of a spur, though a very slight swelling was noticeable in a few plants. The plants were found growing in small colonies among moss and lichens on the very edge of the creek in shady woods.

There is little doubt that the plant described by Cockerell from near

Long's Peak Inn, Larimer County, Colorado, is specifically identical with *C. wyomingensis*, though certain peculiarities, such as the pale orange-tinted sepals and the whitish (not pure white) lip, seem to indicate that *coloradensis* might be separable as a variety. On the other hand, it is quite possible that *C. innata* var. *virescens* Farr,[1] based on specimens from Banff, Alberta, and Field, British Columbia, may be referable to *C. wyomingensis*.

It may be well to consider in this connection the possible relationship of our plant to *C. vancouveriana* Finet,[2] regarded by Prof. Oakes Ames[3] as synonymous with *C. trifida*. Thanks to the courtesy of Prof. Lecomte and his associates, we were enabled, this summer, to examine the type sheet and Finet's original drawings in the Herbarium of the Muséum d'Histoire Naturelle, at Paris. While the two specimens on the sheet are not in very good condition, two of the five flowers of the larger plant are fully developed, and permit a close scrutiny of their structure. As correctly described by Finet, the plant possesses a *very conspicuous exposed* spur; besides, the lateral lobes of the lip are much larger and much more divaricate, and its margin is much less crenulate than in *C. trifida*. There can be no doubt that *C. vancouveriana* is totally different from both *C. trifida* and *C. wyomingensis*. On the other hand, it is so close to certain Mexican species that one is tempted to question the correctness of the locality. The sheet was presented by Sir W. Hooker, in 1855, and the original label reads: "I. Vancouver. Garry, May, 1826."

To Dr. Paul Standley we are much indebted for looking over the manuscript and for supplying the Latin diagnosis.

Fields Museum of Natural History,
Chicago.

CLADONIAS COLLECTED BY S. F. BLAKE IN THE WESTERN UNITED STATES[4]

C. A. Robbins

(Plate 209)

During the summer of 1927 Dr. S. F. Blake collected Cladonias from several localities[5] in the Pacific Coast States and also from

[1] Contrib. Bot. Lab. Univ. Penns., 2, 1904, p. 425.
[2] Bull. Soc. Bot. France, 56, 1909, p. 100, pl. 1, figs. 38–43.
[3] An Enumeration of the Orchids of the United States and Canada, 1924, p. 24.
[4] Mr. C. A. Robbins died on 22 Jan. 1930. This paper was left by him so nearly complete that it has been possible to prepare it for publication without material

three stations in Yellowstone Park, Wyoming. Aside from adding to our knowledge of the distribution of a number of plants which are commonly met with in New England, these collections brought to light one new species and two new forms, as well as some plants not previously reported from North America. It seems advisable, therefore, to record all the species and forms found.

The species are arranged as far as possible after the order of Wainio's "Monographia Cladoniarum Universalis" and his "Lichenographia Fennica." A few departures from these works will be noted, particularly in the splitting up of *Cladonia fimbriata*, and in the treatment of certain other species where the classifications of Harmand or Sandstede seem preferable.

1. Cladonia sylvatica (L.) Hoffm. Wyoming: Canyon Junction, alt. 2375 m.; Upper Geyser Basin, alt. 2240 m.

2. C. tenuis (Floerke) Harm. Wyoming: Upper Geyser Basin, alt. 2240 m.

3. C. bacillaris (Ach.) Nyl. f. subscyphifera Wain. California: Inverness. Not before recorded from America.

4. C. macilenta (Hoffm.) Nyl. f. corticata Wain. Washington: on stump in prairie, Tumwater (sturdy plants, often much branched, the majority too sorediate and intermediate with f. *styracella* (Ach.) Wain.). Previously reported in North America from Connecticut and South Carolina. Also slender, simple plants likewise intermediate between these two forms from redwood stump, La Honda Canyon, and sand dunes, Del Monte, California.

5. C. digitata Schaer. California: Del Monte (thallus).

6. C. deformis Hoffm. m. extensa (Hoffm.) Wain. Wyoming: Upper Geyser Basin. Also f. crenulata (Ach.) Nyl. from the same locality.

7. C. furcata (Huds.) Schrad. var. pinnata (Floerke) Wain.

---

change except for corrections in four specific names. Dr. Alexander W. Evans informs me that three of these, discussed in his recent paper on "The Cladoniae of Connecticut" (Trans. Conn. Acad. **30**: 357–510. 1930), had been agreed to by Mr. Robbins in correspondence. The fourth name (*C. Balfourii*) has priority over the name used by Mr. Robbins in reporting on my specimens. The statements of range extension have been kindly checked by Dr. Evans. A presumably full set of the species and forms recorded, including the types of those described as new, is in the herbarium of Mr. Robbins, which has been given by his widow to the Farlow Herbarium. Another set, containing a complete representation of the localities listed for each species and form, was returned by Mr. Robbins for my own herbarium.—S. F. Blake.

[5] The localities at which specimens were collected are: California: Santa Rosa, Sonoma County; Inverness, Larkspur, and Mt. Tamalpais, Marin County; La Honda Canyon and Santa Cruz Mountains, San Mateo County; Palo Alto, Santa Clara County; Del Monte, Monterey County; Camp Curry, Yosemite National Park, Yosemite County; Fallen Leaf Lake, Eldorado County. Oregon: Wolfcreek, Josephine County. Washington: Tumwater, Thurston County. Wyoming: Mammoth Hot Springs, Upper Geyser Basin, and Canyon Junction, all in Yellowstone National Park.

f. TRUNCATA (Floerke) Wain. CALIFORNIA: Inverness, and on sand dunes, Del Monte.

8. C. SCABRIUSCULA (Del.) Leight. f. **surrecta** (Floerke) Sandst. (*Cladonia furcata* var. *racemosa* f. *surrecta* Floerke, Clad. Comm. 154. 1828). CALIFORNIA: Larkspur and Inverness.—Forma **subnuda** Robbins, forma nova: cortex none, podetia becoming subpellucid, often darkened, smooth or with scattered to contiguous, minute, scale-like, persistent squamules. CALIFORNIA: Santa Cruz Mountains, San Mateo County. (PLATE 209, F. 3.)—And from tufa near Santa Rosa, CALIFORNIA, plants atypical as to form, rather dark and quite squamulose, approaching f. **conspersa** (Wain.) Sandst., n. comb. in litt. (*Cladonia furcata* f. *conspersa* Wain. Act. Soc. Faun. Fl. Fenn. **4** (Monog. Clad. **1**): 355. 1887).

9. C. MULTIFORMIS Merrill f. FINKII (Wain.) Evans and f. SUBASCYPHA (Vain.) Evans. OREGON: near Wolfcreek.

10. C. SUBSQUAMOSA (Nyl.) Wain. WASHINGTON: on stump in prairie, Tumwater (plants variously intermediate between f. *denudata* Arn. and f. *pulverulenta* (R. Br.) Wain.).

11. C. CENOTEA (Ach.) Schaer. f. CROSSOTA (Ach.) Nyl. WYOMING: Upper Geyser Basin (a rather undeveloped state).

12. C. CARIOSA (Ach.) Spreng. WYOMING: Mammoth Hot Springs. CALIFORNIA: on rocks, Camp Curry, alt. 1220 m. (thallus only from both stations).

13. C. ELONGATA (Jacq.) Hoffm. f. ECMOCYNA (Ach.) Vain. and f. LAONTERA (Del.) Vain. (the last beautifully and very diversely developed). WYOMING: Canyon Junction, alt. 2375 m.—Also, from the same locality, forma **intermedia** Robbins, forma nova; podetia moderately short (12–50 mm. tall), squamulose throughout, cup-forming, the cups well expanded. (PLATE 209, F. 1.) Analogous to *C. gracilis* f. *dilacerata*.

14. C. DEGENERANS (Floerke) Spreng. f. EUPHOREA (Ach.) Floerke. WYOMING: Canyon Junction.—Forma CLADOMORPHA (Ach.) Wain. CALIFORNIA: Santa Cruz Mountains.—Forma PHYLLOPHORA (Ehrh.) Flot. WYOMING: Canyon Junction and Upper Geyser Basin; CALIFORNIA: Santa Cruz Mountains.

15. C. VERTICILLATA (Hoffm.) Schaer. f. EVOLUTA (Th. Fr.) Stein and f. PHYLLOCEPHALA (Flot.) Oliv. CALIFORNIA: from tufa near Santa Rosa, and from Santa Cruz Mountains.—Also, from the last station, f. APOTICTA (Ach.) Wain.—Forma CERVICORNIS (Ach.) Floerke. WYOMING: Upper Geyser Basin (thallus; also plants with the podetia well developed and squamulose).

16. C. KREMPELHUBERI Vain. CALIFORNIA: near Fallen Leaf Lake (thallus). Not previously reported from North America.

17. C. MACROPHYLLODES Nyl. WYOMING: Upper Geyser Basin, alt. 2240 m. (thallus; det. Sandstede). Not previously reported from North America.

18. C. CHLOROPHAEA (Floerke) Spreng. f. COSTATA (Floerke) Arn.

California: Inverness and Larkspur. Washington: on stump in prairie, Tumwater.—Also, from the last station, f. prolifera (Wallr.) Arn.; and f. sorediosa Sandst. from Inverness.—Plants atypical as to form from Oregon: near Wolfcreek; Wyoming: Upper Geyser Basin; California: from tufa, near Santa Rosa; Camp Curry; Santa Cruz Mountains; and from sand dunes, Del Monte,[1] the last a quite unusual colony, apparently of new plants but really the proliferations from the podetial or cup squamules of a buried and decaying preceding rank, widely divergent in development.

19. C. conista (Ach.) Robbins; A. F. Allen, Rhodora **32**: 92. 1930. (*Cenomyce fimbriata* β. *C. conista* Ach. Syn. Lich. 257. 1814.) California: among redwoods, Larkspur, and on sand dunes, Del Monte. Doubtless intermediate between *C. fimbriata* and *C. chlorophaea* (see Wainio, Monog. Clad. **2**: 266), but possessing characters which may well be considered specific. Podetia short and with cups well expanded as in *chlorophaea*, but the soredia finely farinaceous as in *fimbriata;* usually more corticate than either, with comparatively large, persistent primary squamules. Widely distributed.

20. C. major (Hag.) Sandst.[2] California: on rocks, Camp Curry, alt. 1220 m.

21. C. fimbriata (L.) Fr.[2] Oregon: near Wolfcreek.

22. C. nemoxyna (Ach.) Nyl. California: Mount Tamalpais, alt. 550 m.; Wyoming: Upper Geyser Basin, alt. 2240 m.

23. C. Balfourii Cromb. (*C. fimbriata* ζ^3 *Balfourii* (Cromb.) Wain.). California: on dry rocks, Palo Alto. With it: forma **subradiata** (Wain.) Robbins, n. comb. (*C. fimbriata* ζ *chondroidea* Wain. ζ^2 *subradiata* Wain. Act. Soc. Faun. Fl. Fenn. **10** (Monog. Clad. **2**): 338. 1894).—The species has been recorded by Wainio from the White Mountains (*Tuckerman*), the forma not hitherto from North America. [In the case of this species and form I have retained Mr. Robbins' identifications but corrected the names used by him to agree with the law of priority. S. F. B.]

24. C. coniocraea (Floerke) Spreng. In various states, from California: Inverness and Camp Curry; Oregon: near Wolfcreek.—Also f. phyllostrota (Floerke) Vain., from California: Mt. Tamalpais; and both f. ceratodes (Floerke) Dalla Torre & Sarnth. and f. truncata (Floerke) Dalla Torre & Sarnth. from the following localities: California: Larkspur, Inverness, and Santa Cruz Mountains; Wyoming: Upper Geyser Basin.

25. C. pityrea (Floerke) Fr. var. Zwackhii Wain. f. subacuta Wain. California: on dry rocks, Palo Alto.

26. C. carneola Fr. Wyoming: Upper Geyser Basin. Also f. simplex Flot. and f. prolifera Flot. from the same locality.

27. C. **Blakei** Robbins, sp. nov.; primary squamules medium-size, the margins entire or irregularly lobed, yellowish above, white be-

[1] Distributed in Sandstede's Clad. Exsicc. as no. 1883.

[2] The usage of Evans, Trans. Conn. Acad. **30**: 474. 1930, is here followed.—S. F. B.

Fig. 1, Cladonia elongata f. intermedia; fig. 2, C. Blakei; fig. 3, C. scabriuscula f. subnuda; all × 2.

neath (or darkening in age), neither sorediate nor granulose, KOH — , CaCl—, (or in combination—); podetia short, stout, cup-forming, cups regular or irregular, imperforate, moderately deep, becoming much expanded (to 14.5 mm. in diameter), the margins entire or repeatedly proliferate, the proliferations one to several, cup-forming or somewhat club-shaped; cortex yellowish, continuous or subcontinuous, smooth or slightly rugose, persistent and *densely covered with small, smooth, subglobose, yellowish squamules,* KOH—, CaCl— (or in combination —); apothecia brown. (PLATE 209, F. 2.)—Type from Upper Geyser Basin, Yellowstone Park, WYOMING, alt. 2240 m., September 6, 1927.—The species is *pyxidata*-like in construction but is distinctly yellow and perhaps not far from *C. carneola* Fr. In the globose-squamulose-covered cortex it resembles *C. santensis* Tuck.

EXPLANATION OF PLATE 209.

Fig. 1. *Cladonia elongata* f. *intermedia.* Fig. 2. *C. Blakei.* Fig. 3. *C. scabriuscula* f. *subnuda.* All × 2, from the types in herbarium of C. A. Robbins.

RECENT CONTRIBUTIONS TO THE FLORA OF WISCONSIN

ALVIN L. THRONE

THE first specimen of *Pterospora andromedea* Nutt. to be recorded from Wisconsin was found by the writer August 14, 1928, while collecting specimens for the herbarium of the State Teachers College of Milwaukee. The specimen was found in the extreme southeastern corner of Ozaukee County, on a rather heavily wooded bluff near Lake Michigan, in the locality known as Donges Bay.

This region is only twelve miles from the heart of Milwaukee but due to the area being dissected by several deep ravines, and because of its scenic beauty, it has been left in its natural state. The soil is a stiff, reddish clay. The dominant tree growth is white pine (*Pinus Strobus* L.) this being one of the few places in southeastern Wisconsin where the species is still found in any number. The specimen of *Pterospora* was found on top of a bluff in a somewhat grassy area (*Poa pratensis* L.) about fifteen feet from the base of a white pine. The region was thoroughly searched and another specimen was found about a fourth of a mile in distance from the first. It was growing on the slope of the ravine in hard clay soil which was covered with a carpet of dead pine needles. The only undergrowth was a few bushes of *Juniperus communis* var. *depressa* Pursh. This specimen is herbarium number 66162 of the Milwaukee Public Museum. The roots of *Pterospora* were found to greatly resemble those of the Beech-drops

Epifagus virginiana (L.) Bart. No direct connection with the roots of the pine was found.

In 1929 three specimens were found. In 1930, one specimen was found in the same locality, but in the very northeastern corner of Milwaukee County. No judgement can be made at this time as to whether the species is indigenous to Wisconsin or whether it is a recent, accidental introduction, but the above observations indicate that the species is fairly well established in this locality.

Another plant, *Amesia latifolia* (Huds.) Nelson & Macbride, new to the Wisconsin flora, was found by the writer July 24, 1930, and is now in the Milwaukee Public Museum, herbarium number 70396. The specimen was found on the north side of a ravine in Lake Park within the city limits of Milwaukee. Lake Park is one of the largest and oldest parks in the city. Within its boundaries are four ravines, the sides of which are covered with the native vegetation. It was in one of these ravines that the specimen of *Amesia* was found while a Nature Study class from the Milwaukee State Teachers College was studying the vegetation of the slope.

The tree and shrub growth of that particular area is composed of *Crataegus*, *Rhus typhina* L., *Thuja occidentalis* L., *Fraxinus americana* L., and a few Austrian Pines (*Pinus nigra* Arnold). All but the latter are native. The Austrian Pines had apparently been transplanted there some fifteen to twenty years ago. The ground vegetation is entirely native, being largely *Solidago*, *Aster*, and *Osmorhiza longistylis* (Torr.) DC. The soil is hard clay.

Search was made in all the ravines of the park but no other specimens were found. As with *Pterospora*, it is impossible to say if the plant is indigenous or of recent, accidental introduction. Under the conditions where found, the latter seems more probable. However, it is true that any indigenous plant within the park, might have better chances of surviving due to the protection received, than if it were in the country near a large city. Gray's Manual of Botany, Seventh Edition, lists *Amesia* (as *Serapias Helleborine*) as having been found as far west as New York and Pennsylvania. The Wisconsin station thus extends the range of the species about five hundred miles farther west.

Identification of the specimens was verified by Mr. Albert M. Fuller, Assistant Curator of Botany of the Milwaukee Public Museum.

State Teachers College,
Milwaukee, Wisconsin.

POLLEN OF SPARGANIUM AMERICANUM AND S. ANDROCLADUM

Harry V. Truman

In connection with the pollen analysis of a peat bog situated in a kettle-hole in the glaciated area of Wisconsin it was found necessary to make a study of the pollen characteristics of certain species of *Sparganium*. Although no key has been prepared for the identification of the species of this genus, certain observed differences in the characteristics of the pollen of two of them, namely, *S. americanum* Nutt. and *S. androcladum* (Engelm.) Morong, are of interest because of the confusion that has existed in the past in regard to these species.

Fernald[1] identified *S. lucidum* Fernald & Eames with *S. androcladum* and noted that, while the species is abundant in Missouri and adjacent Illinois, it is otherwise unknown or unrecorded between the Mississippi valley and eastern Pennsylvania. Fassett[2] found two stations of the species, both in kettle-holes, in Wisconsin where it was hitherto unrecorded. Two specimens of *S. androcladum* were used in this study, one collected at Gibraltar Rock, Lodi, Wisconsin, Oct. 3, 1926, *Fassett & Wilson*, no. 2889, the other at West Roxbury, Massachusetts, *Forbes*, no. 17204. Specimens of *S. americanum* collected at Dundee, New York, *Wright*, New Bedford, Massachusetts, *Greene*, Lone Rock, Wisconsin, *Davis*, 1921, Spring Green, Wisconsin, *Davis*, 1922 and Haugen, Wisconsin, *Davis*, 1923 were used.

Sparganium pollens are thin-walled and collapsible. Sears[3] describes one of them ("*S. eurycarpum?*") as being spherical and monopored, with a thin, granular surface. The pollens of *S. androcladum* and *S. americanum* were found to differ from each other in the character of the granulation of the surface and in size. *S. androcladum* has a granular surface with a clean-cut outline throughout all, or at least the greater part, of its circumference. *S. americanum* shows a papillate surface which gives the outline of the grain much the appearance of a small-toothed cog-wheel, the intervals between the papillae being but slightly smaller than the diameter of the papillae. The pollen of *S. androcladum* averaged 28.4 mu. in diameter, that of *S. americanum* averaged 24.5 mu. Normal pollen grains were selected for measurement in each case (*i. e.*, badly collapsed or torn grains were not con-

[1] Fernald, Rhodora **24**: 27 (1922).
[2] Fassett, Trans. Wis. Acad. Sci. Arts and Letters **25**: 186 (1930).
[3] Sears, Bot. Gaz. **89**: 95 (1930).

sidered) and the measurements were made of the longest diameters where they were not exactly spherical.

University of Wisconsin

A NEW SELENIA FROM THE EDWARDS PLATEAU OF TEXAS

V. L. Cory, Grazing Research Botanist

Selenia **Jonesii**, sp. nov., herba annua hiemans *prostrata* glabra, foliis petiolatis pinnatis bipinnatisve segmentis parvis oblongis, racemis folioso-bracteatis, floribus parvis luteis suaveolentibus, siliquis stipitatis ad 15 mm. longis, 10 mm. latis *subglobosis* vel ellipsoidalibus *inflatis* stylo breve crasso.

A prostrate, glabrous, winter annual from a slender tap-root; branches leafy and up to 15 cm. or more in length; leaves petioled, up to 5 cm. long, pinnately or bipinnately divided into small, oblong, obtuse or acute segments 1–3 mm. long, the terminal segment usually being longer than the others and, in growth, subjected to further lobing; petioles slender and elongated, narrowly winged, and extending into a mid-vein more widely winged; racemes leafy-bracted and frequently clustered at the crown of the plant, but occurring also along the spreading branches; flowers small, yellow, fragrant, 5–6 mm. long; sepals shorter and paler than the petals, up to 5 mm. long, spreading; petals yellow, oblanceolate, up to 6 mm. long, erect; pedicels slender, spreading or slightly ascending, 1–3 cm. long; siliques stalked, up to 15 mm. long and 10 mm. broad, subglobose to elliptical, inflated, surmounted by a broad style which is 3 mm. high and 2 mm. broad at the base; seeds 10 or more, 2-rowed in each cell, orbicular, broadly winged, 3.5 mm. wide by including the margin which adds slightly more than one mm. to the width of the seed.

This species differs from the other species of Selenia in its prostrate growth and in its shorter, broader, and inflated fruit. Also it differs from *Selenia aurea* Nutt. in its shorter and stouter style, and differs from *Selenia dissecta* Torr. in having flowers half or less than half as large. The inflation of the fruit, after the fashion of *Physaria*, marks it clearly as a distinct new species.

The first collections of this species were made March 20, 1929, at the headquarters of the W. R. Baggett Ranch, 3 miles north of Ozona, Texas, and the same day at the Six Mile Water-hole on Johnson Draw at about six miles north of Ozona, and also on Mr. Baggett's ranch. These collections were discarded, when better specimens

were collected the next day at a water-hole on Howard Draw at about twelve miles above the Old Spanish Trail crossing of the Draw at about eighteen miles northwest of Ozona, the county-seat of Crockett County, Texas. The collections (Nos. 323 and 324) made on Howard Draw, March 21, 1929, were of plants in full flower, but without any fruit whatever. The *Selenia* had made excellent growth, and, at four water-holes in these two Draws, it grew abundantly in the mud and moist ground surrounding the water, while only a few plants of other species were present. As these plants were new to me and the fruit was lacking to permit certain placing in its proper genus, sheet No. 324 was sent to the Gray Herbarium. Through the kindness of Dr. Ivan M. Johnston a report was received that apparently the plant was a *Selenia*, but, if so, it was distinctly a new species. Postponement of further study was made until the plant could be collected in fruit.

In 1930 the late winter and early spring were exceptionally dry and all water-holes in Crockett County dried up, and thus it was that only a few rather unsatisfactory plants could be found on April 15th when fruiting specimens were obtained. These collections (Nos. 2992–3000, both inclusive) proved that the plant was really a *Selenia.* All were obtained at the Six Mile Water-hole in Johnson Draw. The type specimen, No. 2992, is deposited at the Herbarium of the Texas Agricultural Experiment Station at College Station, Texas. Collections Nos. 324 and 2993 are deposited at the Gray Herbarium, collection No. 2994 is deposited at the Missouri Botanical Gardens, and collection No. 2995 is deposited at the Field Museum of Natural History.

On the occasion of the collections of 1930 the writer was accompanied by the noted Western botanist, Prof. Marcus E. Jones of Pomona College, Claremont, California, who took the opportunity to make a series of collections of this plant. To commemorate his visit to the Edwards Plateau country of Texas and to express appreciation of the opportunity thus afforded to make his acquaintance and to gain his friendship it is our wish to name this species in his honor.

It appears probable that this species is confined to Crockett County, Texas, for the writer has not seen it at the water-holes in draws elsewhere in the Edwards Plateau or on further west in the Trans-Pecos

area of the State; but a more thorough search is required before this may be accepted as a fact.

Grateful acknowledgement is made to Dr. Ivan M. Johnston and to Prof. Marcus E. Jones for advice and assistance given in the study of this species.

Texas Agricultural Experiment Station.

Drosera rotundifolia, var. comosa in Connecticut.—In the course of a morning's botanizing last August on a small floating bog at Donovan's Pond, Mansfield, Connecticut, I was hunting around in the sphagnum for pitcher-plant seedlings when I noticed a queer-looking sundew, whose reddish, capitate inflorescences were distinctly different from the elongate, white-flowered racemes of ordinary *Drosera rotundifolia.* The material was tentatively referred to *Drosera rotundifolia* L., var. *comosa* Fernald, an identification which I was recently able to confirm by examining specimens from the other known stations at the Gray Herbarium. The Connecticut plants do not show a transformation of the carpels or perianth into gland-bearing leaves, but the same may be said of several of the plants of the type collection. This peculiar variety has only once before been reported from New England (Mt. Desert, Maine, *Stebbins*), and is otherwise known only from Gaspé and from Central New York. My scanty collection, four plants in all, is in the College Herbarium.—G. S. Torrey, Connecticut Agricultural College.

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CLADONIA IN THE DISTRICT OF COLUMBIA AND VICINITY

C. A. ROBBINS[1] AND S. F. BLAKE

(Plates 210–212)

THE genus *Cladonia,* of which the largest and most familiar examples are the various species of reindeer-moss, occupies much the same position among lichens as is held by such genera as *Salix* and *Rubus* among flowering plants. The species are numerous, often very variable, and sometimes distinguishable only by differences in chemical reaction, so that, although the commoner species are for the most part easily recognized, the acquisition of a thorough knowledge of the forms occurring even in a somewhat restricted region is the work of years. In consequence, the study of the genus affords an interesting and profitable occupation for the student of flowering plants who seeks an object for his walks afield during the months of winter and early spring. It is at such times, when banks and fields are bared by melting snow, that many Cladonias are most conspicuous and can be collected in the best condition for study.

The external morphology of Cladonias is simple. A typical representative, *Cladonia cristatella* (see. PL. 210, F. 14), the common scarlet-fruited species found on earth or decaying wood, consists of three chief parts. From the horizontal part, known as the *primary thallus*, and composed of *squamules*, arise vertical stalks (*podetia*) bearing fruiting bodies (*apothecia*). In the reindeer-mosses (PL. 210, F. 1–5) the primary thallus is evanescent and very seldom seen, the plants consisting of masses of much branched, intertangled podetia. In different species the podetia (which are very rarely absent) may

[1] The senior author died on 22 Jan. 1930. In the final preparation of this paper for publication, material assistance has been given by Dr. Alexander W. Evans.

be short or comparatively long, simple or greatly branched, cylindrical or clavate. When more or less clavately enlarged and hollowed out at apex they are described as *cup-forming* (see pl. 210, f. 11–12; pl. 212, f. 3–4). Their surface, except in the reindeer-mosses, is usually *corticate*, that is, provided with a subcrustaceous outer layer, which often becomes broken and dispersed, leaving *interspaces* which expose the more downy *medulla*. In several species the podetia, rarely also the squamules, are more or less completely *decorticate* and *sorediose* (or *sorediate*), that is, covered with masses (*soredia*) of fine whitish powder, which under the microscope are found to consist of intertangled algal cells and fungal hyphae (see pl. 210, f. 9–10). In other cases the podetia may be *granulose*, *squamulose*, or *squamose*, the first term referring to the presence of coarse soredia, the two latter to the presence of small or large squamules similar to those of the thallus. The podetia, when cup-forming, are frequently *proliferous* from the center or margins of the cups in one or more series, the successive tiers of proliferations being known as *ranks* (see pl. 212, f. 4, 7). In the reindeer-mosses the character of the *gonidia*, small wart-like bodies on the podetia, is often of importance in the separation of the species.

The fundamental work for the study of Cladonias is Wainio's "Monographia Cladoniarum universalis," published in three parts[1] from 1887 to 1897. An illustrated account of the morphology of the genus, with photographs of several species, is given in Fink's "Lichens of Minnesota."[2] A key to the New England species and principal varieties then recognized was given in 1909 by the late Prof. L. W. Riddle.[3]

The latest and most generally useful publication on North American Cladonias is Dr. Alexander W. Evans' "The Cladoniae of Connecticut."[4] In this paper the author, in addition to a discussion of the recent important literature, morphology, local distribution, and habitats of the genus, has given carefully prepared keys to the groups, species, and minor forms occurring in Connecticut, with synonymy and abundant annotations. The 45 species treated include nearly

[1] Act. Soc. Faun. Fl. Fenn. **4**: 1–509. 1887; **10**: 1–498. 1894; **14**: 1–268. 1897. The first two parts are systematic, the third general.—In his most recent works Wainio altered the spelling of his name to Vainio, and both forms occur in the list of species in this paper.

[2] Contr. U. S. Nat. Herb. **14**: 107. *pl.* 11–17. 1910.

[3] Rhodora **11**: 212–214. 1909.

[4] Trans. Conn. Acad. **30**: 357–510. June, 1930.

all those which are common in the temperate eastern United States, so that the paper is of value to workers outside the area specially covered.

The present list of Cladonias of the District of Columbia and immediate vicinity is based on the local material of this genus in the U. S. National Herbarium collected by E. Lehnert (ca. 1884), J. M. Holzinger (1892), T. A. Williams (1890–1900), William R. Maxon (1899–1903), Mary F. Miller (ca. 1904–13), and Bruce Fink (1907), and on the collections of S. F. Blake (1924–26, and a single specimen collected in 1930). The last have practically all been determined by C. A. Robbins, who has also been able, through the kindness of Dr. William R. Maxon, to examine critically a number of specimens by earlier collectors preserved in the National Herbarium. All the species and forms listed in this paper have been collected in the region by the junior author except *C. mitis* and *C. alpicola* var. *karelica*, and all, except these two species and two forms (*C. chlorophaea* f. *centralis* and *C. strepsilis* f. *subsessilis*), are represented in his herbarium. Material of the two forms mentioned was identified by the senior author and is presumably preserved in his herbarium.

The only list of Cladonias of the District of Columbia region hitherto published is that by Rev. E. Lehnert (1886), forming a part of F. H. Knowlton's supplement to L. F. Ward's "Guide to the flora of Washington and vicinity," and including[1] the names of 20 species and 11 additional varieties. Examination of the material in Lehnert's herbarium, now incorporated in the United States National Herbarium, shows that a number of his species were misidentified. His *C. macilenta* and *C. Floerkeana* are *C. cristatella* f. *vestita;* his *C. pulchella* is *C. vulcanica* f. *minor*; his *C. symphycarpa* and *C. cariosa* are misnamed, being mixtures of several species; his *C. gracilis* is *C. chlorophaea* and *C. verticillata.* His *C. decorticata, C. degenerans, C. santensis,* and *C. leporina,* not now represented by specimens, cannot be identified, but it seems likely that all were incorrectly named. Lehnert's specimens of *C. alpicola* var. *karelica,* originally labeled *C. symphycarpa* and later *C. cariosa,* are the only ones known from the region.

Two principal floral areas are recognized for flowering plants in the District of Columbia region.[2] The Piedmont Plateau, characterized

[1] Proc. Biol. Soc. Washington 3: 123–4. 1886.

[2] See W. L. McAtee, "A sketch of the natural history of the District of Columbia," Bull. Biol. Soc. Washington 1: 57–90. 1918.—The area covered in the present

by the presence of metamorphic and igneous rocks, with caps of Coastal Plain deposits on the hilltops and on divides between streams, is separated by the Fall Line from the Coastal Plain of unconsolidated clays, gravels, and sands. Of the 36 species of *Cladonia* here listed, 23 show no sign of restriction in local habitat. Three species—*Cladonia coccifera*, *C. Floerkeana*, and *C. floridana*—are known only from the Coastal Plain. All are rare, occurring together at a single locality near Bladensburg and not elsewhere, except *C. floridana*, which has been collected at Lanham, two or three miles further east. *Cladonia squamosa* is most abundant in Coastal Plain areas, occurring only sparingly elsewhere. Seven species—*C. Boryi*, *C. foliacea*, *C. mitis*, *C. pityrea*, *C. polycarpia*, *C. pyxidata*, and *C. vulcanica*—are known only from Piedmont areas, and *C. furcata* is scarce outside the Piedmont region. One species, *C. alpicola*, is represented only by a single unlocalized collection. The wide range of Cladonias in general is shown by the fact that, of the 36 species here listed, at least 19 are recorded from Finland by Vainio, while only 11 are not found in some part of Europe.

The identifications on which this paper rests have practically all been made by the senior author, who is also responsible for the key. The introduction and annotated list of species were also examined and corrected by him. The illustrations in this paper represent average specimens, not specimens selected to show extremes of development.

KEY TO GROUPS AND SPECIES

Subg. 1. *Cladina* (Nyl.) Wain. Primary thallus crustaceous, evanescent, seldom seen. Podetia slender, elongated, much branched, arachnoid-tomentose and without cortex but often with a pseudo-cortex formed of scattered or contiguous gonidia; apices minutely 2–8-forked; apothecia fuscous, small, often absent.—Plants intricately massed-entangled. The reindeer-mosses.

Plants ashy grayish, not at all yellowish, coarse; KOH+ (distinctly yellow).[1] (Pl. 210, f. 1.)......1. *C. rangiferina*.

paper on Cladonia is the same as that of the "Flora of the District of Columbia and Vicinity," by A. S. Hitchcock and P. C. Standley (Contr. U. S. Nat. Herb. **21**. 1919)—a circle of approximately 15 miles radius with the Capitol as a center.

[1] Nearly all species of Cladonia give a color reaction when touched with a saturated solution of caustic potash. In many cases this is merely a brightening of the natural color of the plant. Several species, however, undergo a distinct and immediate color change. In some the reaction is best obtained by using KOH in combination with a saturated solution of chloride of lime. Usually the reaction is yellow. In *C. strepsilis* with CaCl (alone) it is immediately bluish-green, and in *C. subcariosa* and *C. polycarpia* (with KOH alone) it is slowly red or reddish brown. A plant's reaction, therefore, whether positive or negative, is often of diagnostic value. In the keys here given the reaction is not mentioned where it has no such value. Unless otherwise stated, the plus sign indicates that the reaction is yellow, the minus sign that there is no color reaction.

Plants yellowish-green, varying to white, green, or gray, usually more delicate; KOH – (or pale yellow in *C. tenuis*).

Gonidia dissolving.—Podetia irregularly branched or often subdichotomously divided throughout, here and there roughened with disintegrating gonidia; gonidia greenish, whitish, or yellowish, often darkening, the interspaces soon naked and often pellucid. (Pl. 210, f. 2.)............5. *C. impexa.*

Gonidia persistent.

Podetia with the branches neither radiate nor whorled, subunilateral throughout; axils in part closed; apices soon nodding; KOH + (pale yellow). (Pl. 210, f. 3.)........3. *C. tenuis.*

Podetia with the branches irregularly to subregularly radiate or whorled; axils gaping; KOH –.

Branches with abundant subsecund branchlets; apices nodding, minutely 3–8-pointed; gonidia grayish, greenish, or occasionally brownish, the interspaces tomentose. (Pl. 210, f. 4.)....2. *C. sylvatica.*

Branches with usually few dichotomously divided branchlets, the branchlets slender, tapering, divaricate, straight; apices minutely forked or 3–5-pointed; gonidia whitish to yellowish, the interspaces smooth. (Pl. 210, f. 5.)....4. *C. mitis.*

Subg. 2. *Pycnothelia* Ach. Primary thallus granular-crustaceous, persistent. Podetia short, stout, simple or short-branched, corticate, suggesting minute cacti; terminations obtuse; apothecia small, fuscous.—Plants not intertangled. (Pl. 210, f. 6.)..................6. *C. papillaria.*

Subg. 3. *Cenomyce* (Ach.) Th. Fr. Primary thallus foliaceous, persistent or disappearing.

Series A. *Cocciferae* Del. Apothecia scarlet (whitish in rare color-forms).

a. *Subglaucescentes* Wain. Primary squamules grayish-green above, white beneath; podetia whitish to grayish-green. (In the region here dealt with, represented only by plants having the podetia often sterile, with obtuse to subulate apices, mainly or wholly decorticate, the decorticate areas farinose-sorediate or granulose.)

Decorticate areas pellucid and granulose or granulose-squamulose, usually darkening, KOH +. (Pl. 210, f. 7.)..........7. *C. vulcanica.*

Decorticate areas impellucid and farinose-sorediate, usually whitish.

Podetia usually basally corticate, above with the cortex dispersed or more or less continuous particularly below the apices; KOH –. (Pl. 210, f. 8.)......8. *C. Floerkeana.*

Podetia occasionally basally corticate, above wholly decorticate and farinose-sorediate.

KOH –. (Pl. 210, f. 9.)..........9. *C. bacillaris.*

KOH +. (Pl. 210, f. 10.).........10. *C. macilenta.*

b. *Stramineo-flavidae* Wain. Primary squamules yellowish-green above, white or yellowish beneath; podetia yellowish-green.

Podetia cup-forming, sterile or fertile (CaCl) KOH +.

Cortex persistent, not at all sorediate. (Pl. 210, f. 11.) . . . . 11. *C. coccifera.*

Cortex disintegrating, more or less sorediate. (Pl. 210, f. 12.) . . . . 12. *C. pleurota.*

Podetia not cup-forming, always terminated by apothecia; cortex continuous to areolately dispersed or wanting; (CaCl) KOH −.

Plants not at all sorediate; podetia typically short-branched above; decorticate areas persistently arachnoid, whitish. (Pl. 210, f. 14.) . . . . 13. *C. cristatella.*

Plants more or less sorediate; podetia typically club-shaped: decorticate areas naked, subpellucid, soon darkening. (Pl. 210, f. 13.) . . . . 14. *C. paludicola.*

Series B. *Ochrophaeae* Wain. Apothecia brown to pale flesh-color.

a. *Unciales* (Del.) Wain. Primary thallus evanescent, rarely seen. Podetia not persistent basally, cylindrical to irregularly turgescent, corticate, never squamulose, becoming much branched and intertangled; cortex usually smooth and shining; *apices spinose.*—In the massed habit of growth the group resembles the Cladinas. It can readily be distinguished from them by its conspicuous cortex, and (as well as from all other species here listed) by its spinose-tipped podetia.

Podetia corticate, the surface usually smooth. (Pl. 211, f. 1.) . . . . 15. *C. uncialis.*

Podetia more or less decorticate, the surface roughened by depressions or perforations. . . . . . . 16. *C. Boryi.*

b. *Chasmariae* (Ach.) Floerke. Primary thallus persistent or disappearing, the squamules white beneath. Podetia usually persistent basally, *cupless or with open cups* (i. e., not closed by a diaphragm); axils usually open.

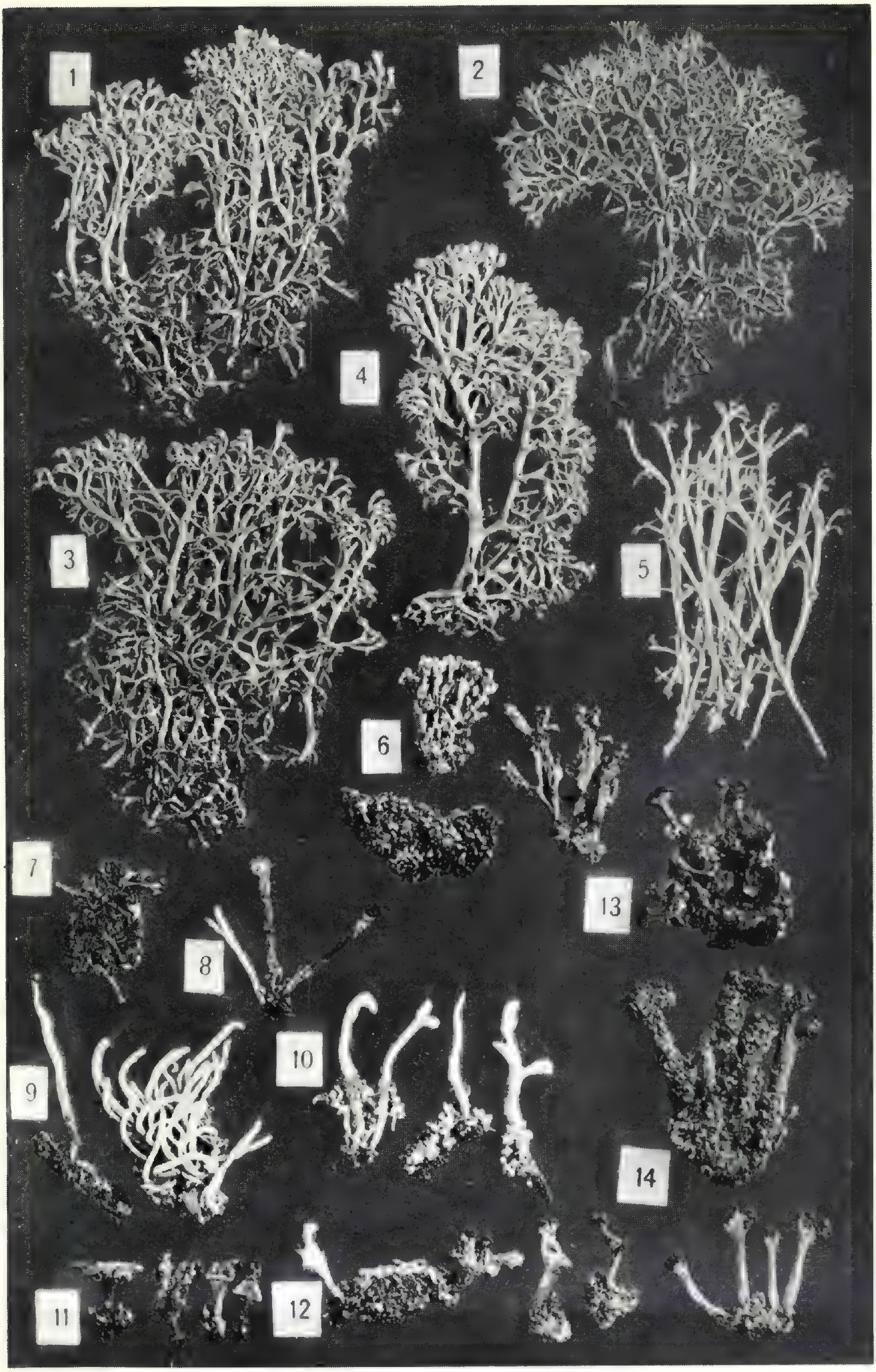
Primary squamules large; segments elongated, the margins entire or sinuate; podetia none; apothecia (usually wanting) sessile on the primary squamules; KOH +. (Pl. 211, f. 7.) 22. *C. apodocarpa.*

Primary squamules small to medium, the margins segmented; segments crenate to finely incised.

Podetia essentially none; apothecia (usually present) sessile or short-stalked on the primary squamules; KOH −. (Pl. 211, f. 6.) . . . . 21. *C. caespiticia.*

Podetia conspicuously developed.

Podetia cup-forming, the cups well developed and conspicuous to very small; cortex disintegrating, but in local forms neither sorediate nor granulose; KOH −. (Pl. 211, f. 5.) 20. *C. squamosa.*



Figs. 1–5, CLADONIA, subg. CLADINA; fig. 6, subg. PYCNOTHELIA; figs. 7–14, subg. CENOMYCE, series COCCIFERAE.

Podetia not cup-forming.
Plants sorediate, granulose or granulose-squamulose, usually very small and delicate, growing on decaying wood; podetia short, often simple; cortex dispersed to wholly wanting; KOH+. (Pl. 211, f. 3.) 18. *C. delicata.*
Plants neither sorediate nor granulose, growing normally on earth.
Podetia short-branched; cortex areolate; apices obtuse; axils round-perforate; KOH+. (Pl. 211, f. 2.) 17. *C. floridana.*
Podetia much branched, the branches slender, elongated; cortex continuous to areolate; apices often subulate; axils irregularly gaping; KOH−. (Pl. 211, f. 4.)...............19. *C. furcata.*

c. *Clausae* Wain. Primary thallus persistent or disappearing, the squamules white or creamy beneath. Podetia usually persistent basally, *cupless or with closed cups* (i. e., closed by a diaphragm); axils closed. Plants not intertangled.
Primary squamules grayish-green to olivaceous above, beneath white, not yellowish anywhere.
Podetia cup-forming.
Plants neither sorediate nor granulose.
Cups irregular, shallow, usually partly or wholly obliterated by irregular marginal or occasionally central proliferations. (Pl. 212, f. 8.)......32. *C. mateocyatha.*
Cups regular.
Cups deep (goblet-form); proliferations normally marginal; cortex smooth to warty-areolate (Pl. 212, f. 3.).............. 28. *C. pyxidata.*
Cups very shallow (saucer-form); proliferations normally central, usually several-ranked; cortex smooth. (Pl. 212, f. 7.)...33. *C. verticillata.*
Plants sorediate or granulose.
Soredia farinaceous; squamules coarse, with margins somewhat lobate; cups narrow, often abortive or obsolete. (Pl. 212, f. 5.).................30. *C. coniocraea.*
Soredia granulose.
Cups deep and large. (Pl. 212, f. 4.).............29. *C. chlorophaea.*
Cups shallow, irregular or abortive, small. (Pl. 212, f. 6.).................31. *C. pityrea.*

Podetia not cup-forming.
Plants sorediate or granulose.
Soredia farinaceous; primary squamules usually large, with margins sublobate; apices subulate. (Pl. 212, f. 5.) 30. *C. coniocraea.*
Soredia granulose; primary squamules small; apices acute to subobtuse. (Pl. 212, f. 6.). 31. *C. pityrea.*
Plants neither sorediate nor granulose.
Primary squamules small to minute; podetia slender, simple, often short, usually somewhat tortuous, always terminated by comparatively large apothecia; cortex dispersed, often wholly wanting; KOH –. (Pl. 211, f. 8.) .... 23. *C. mitrula.*
Primary squamules medium to large; podetia regularly to irregularly club-shaped, often stout, simple or with short, obtuse branches, sterile or fertile.
Podetia greenish, laterally much fissured and torn (cancellate-cariose); cortex becoming dispersed in small subpeltate areoles; KOH –. (Pl. 212, f. 2.) 27. *C. alpicola.*
Podetia grayish-green to olivaceous, laterally subentire or here and there depressed or flattened; cortex continuous to areolate.
Plants CaCl + (bluish-green). (Pl. 212, f. 10.) .... 35. *C. strepsilis.*[1]
Plants CaCl –
KOH –. (Pl. 212, f. 1.) 26. *C. clavulifera.*
KOH + (yellowish, soon brick-red). (Pl. 211, f. 9.) .... 24. *C. subcariosa.*
KOH + (persistently yellow mixed with red). (Pl. 211, f. 10.) 25. *C. polycarpia.*
Primary squamules distinctly yellowish.
CaCl (KOH) + (bluish green). (Pl. 212, f. 10.) 35. *C. strepsilis.*
CaCl (KOH) + (yellow).
Squamules large, yellowish above, cream-colored or whitish beneath, with rounded segments, the margins

[1] No other Cladonia species yields this color reaction to chloride of lime (particularly when followed by KOH). The under surface of the squamules shows it most conspicuously.

entire or subentire; podetia and apothecia rarely developed. (Pl. 212, f. 9.) . . . . .34. *C. foliacea.*[1]

Squamules small to medium, yellowish above, white beneath, with incised margins; podetia slender, simple or fastigiately much branched, the branches short; cortex cracked and dispersed in flat or recurved, partly detached patches; apothecia minute to large, often abundant. (Pl. 212, f. 11.) . . 36. *C. piedmontensis.*

1. C. RANGIFERINA (L.) Web.—PL. 210, F. 1.—In moss among rocks in woods, scarce (near Prospect Hill, Fairfax Co., Va.; on clayey bank, edge of mixed woods, near Lanham, Md.; and on slope in pine woods, Burnt Mills, Md., *Blake*). In addition to the typical form, the f. CRISPATA Coem., a small form with densely crowded, intertangled branches, has been collected.

2. C. SYLVATICA (L.) Hoffm.—PL. 210, F. 4.—Clayey ground, on edge of woods, scarce (near Landover, near Lanham, Burnt Mills, and Suitland bog, Md., and near Mt. Vernon, Va., *Blake*). Among the specimens collected are some referable to f. PYGMAEA Sandst., a dwarf form, and others to f. SPHAGNOIDES (Floerke) Oliv., with the podetia well branched from near base to apex, and the upper branchlets and apices erect or suberect.

3. C. TENUIS (Floerke) Harm.—PL. 210, F. 3.—In similar habitats to *C. impexa*, sometimes growing with that species, but less common (*Miller, Blake*).

4. C. MITIS Sandst.—PL. 210, F. 5.—Dry roadside bank near Great Falls, Va. (*Miller*).

5. C. IMPEXA Harm.—PL. 210, F. 2.—In poor soil in pine or deciduous woods, sometimes on banks or rocks, abundant (*Lehnert, Fink, Miller, Blake*). The following forms have been found typically developed: f. CONDENSATA (Floerke) Sandst. (*Cenomyce silvatica* var. *condensata* Floerke), a dense low form; and f. LAXIUSCULA (Del.) Sandst. (*C. sylvatica* var. *laxiuscula* Del., in part), with nodding apices. This appears to be the commonest species of the reindeer-moss group in our region, and is rarely found except in a sterile condition. The earlier collections were referred to *C. rangiferina* or *C. sylvatica*, both of which, as now interpreted, seem to be scarce here.

6. C. PAPILLARIA (Ehrh.) Hoffm.—PL. 210, F. 6.—Fields and hillsides, in sandy or clayey soil, fairly common (*Lehnert, Miller, Blake*). Represented by three forms: f. MOLARIFORMIS (Hoffm.) Schaer., with podetia well developed, often much branched: f. PAPILLOSA Fr., with podetia papilliform; and f. STIPATA Floerke, with podetia sterile and very densely papillose-branched above.

[1] The usually large spreading colonies of coarse yellowish squamules are conspicuous and characteristic. The chemical response to KOH combined with CaCl is also diagnostic.

7. C. vulcanica Zolling. f. **minor** Robbins, n. forma.—Pl. 210, f. 7.—Podetia only 2.5–8 mm. high; otherwise as in *C. vulcanica*.—"District of Columbia" (*Lehnert*); on old log in woods, Lyonhurst, Arlington Co., Va. (*Miller*); on old log in woods, Prospect Hill, Fairfax Co., Va., 17 Feb. 1925 (*Blake;* type collection); on logs, Riggs Mill and vicinity, near College Park, Md. (*Blake*).

Cladonia vulcanica Zolling. differs from *C. didyma* (Fée) Wainio in its yellow reaction with caustic potash, as does *C. macilenta* from *C. bacillaris*, and should likewise be given specific rank. It has apparently not hitherto been recorded north of Mexico. The f. *minor* differs only in its diminutive podetia; those of the typical plant are described by Wainio as 8–45 mm. long.

8. C. Floerkeana (Fr.) Floerke.—Pl. 210, f. 8.—Sandy loam in clearing, at one locality in vicinity of Landover, near Bladensburg, Md. (*Blake*). The specimens collected belong to var. intermedia Hepp, with sorediose, esquamose podetia.

9. C. bacillaris (Ach.) Nyl.—Pl. 210, f. 9.—On logs, stumps, and bases of trees, rarely on ground, common (*Fink, Miller, Blake*). Most of our material belongs to f. clavata (Ach.) Wain.

10. C. macilenta Hoffm.—Pl. 210, f. 10.—On decaying logs in woods, on rocks, or in clearings, apparently rare (*Fink, Blake*). All material collected belongs to f. styracella (Ach.) Wain.

11. C. coccifera (L.) Willd.—Pl. 210, f. 11.—Sandy loam in clearing, at one locality in vicinity of Landover, near Bladensburg, Md. (*Blake*). Specimens collected represent var. stemmatina (Ach.) Wain., without squamae on podetia or cups, and var. phyllocoma Floerke, with the podetia and particularly the margins of the cups squamose.

12. C. pleurota (Floerke) Schaer.—Pl. 210, f. 12.—In woods, in clearings, and on banks, sometimes on exposed rocks, not common (*Lehnert, Miller, Blake*). In addition to the common form, with naked podetia of medium length, the following forms occur: f. decorata (Wain.) Evans, with short esquamose podetia 4–10 mm. long, and apothecia sessile on margins of cups; var. frondescens (Nyl.) Oliv., with squamose podetia; and var. cerina (Nagel) Th. Fr., with whitish apothecia (rare; Plummer Island, Md.).

13. C. cristatella Tuck.—Pl. 210, f. 14.—On ground in fields and woods and on banks, occasionally on logs or the bases of trees; an abundant and beautiful plant (*Lehnert, Holzinger, Maxon, Williams, Fink, Miller, Blake*). Represented by the following forms: f. Beauvoisii (Del.) Wain., with naked podetia and scarlet apothecia (common); f. ochrocarpia Tuck., similar but with pale flesh-colored or whitish apothecia (rare); f. vestita Tuck., like f. Beauvoisii but with podetia squamulose (abundant); and f. squamulosa Robbins, like f. *vestita* but with whitish or flesh-colored apothecia (rare; non-

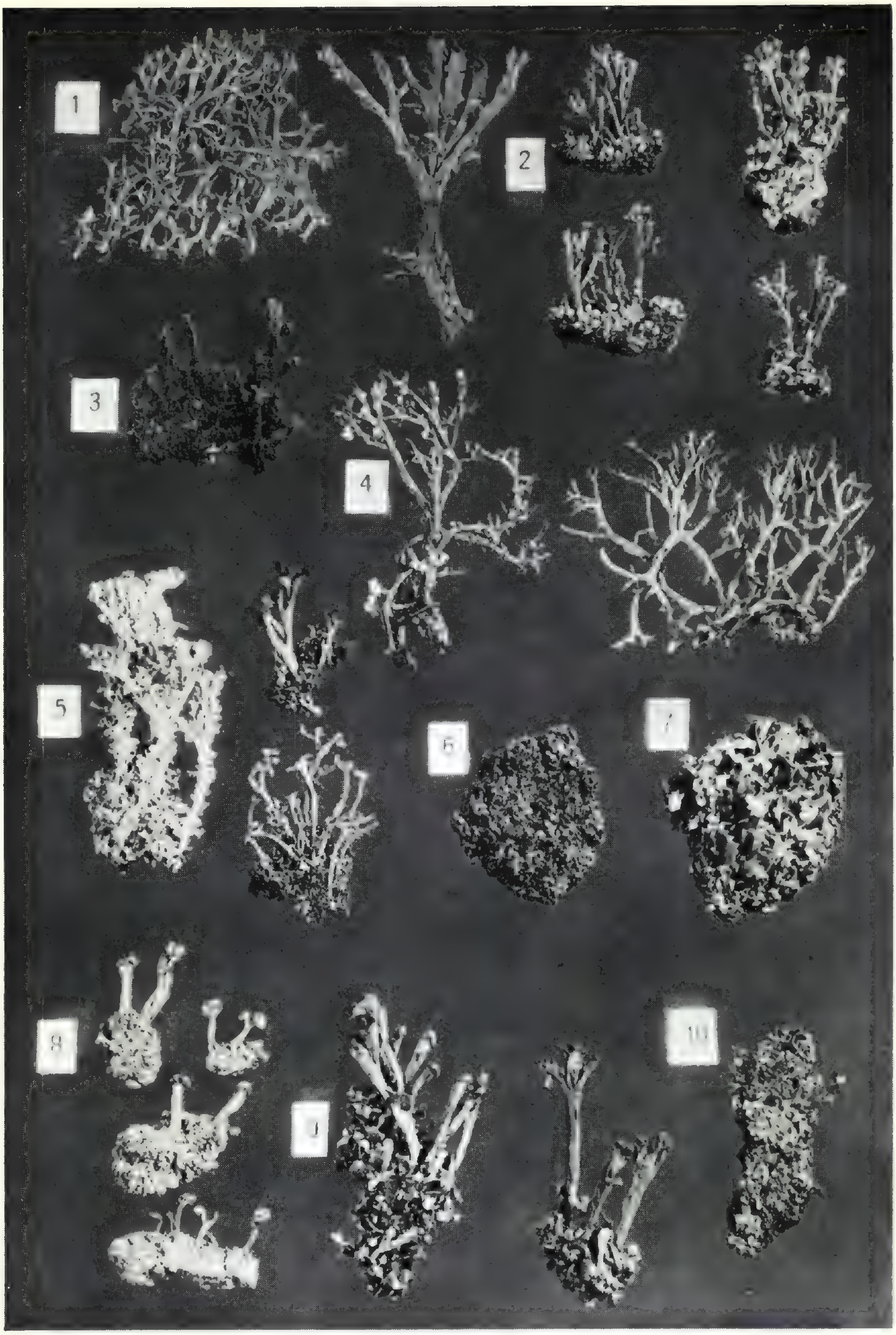


Fig. 1, CLADONIA, subg. CENOMYCE, ser. OCHROPHAEAE, subser. UNCIALES; figs. 2–7, subser. CHASMARIAE; figs. 8–10, subser. CLAUSAE.

typical plants from Great Falls, Va., and an intermediate plant toward f. *vestita*, bearing a few small scarlet apothecia mixed with abundant whitish ones, near Mt. Vernon, Va.).

14. C. PALUDICOLA (Tuck.) Merrill, Bryologist **27**: 23. 1924.—PL. 210, F. 13.—On old log in woods, near Lyonhurst, Arlington Co., Va. (*Miller*); on decaying stump in pine woods, vicinity of Landover, near Bladensburg, Md. (*Blake*).

15. C. UNCIALIS (L.) Web.—PL. 211, F. 1.—Sandy or clayey ground in woods or on banks, sometimes on rocks, fairly common (*Lehnert, Miller, Blake*). The following forms have been collected: f. DICRAEA (Ach.) Wain., with dichotomously branched podetia with subulate apices, the axils more or less pervious; f. OBTUSATA (Ach.) Nyl., with polytomously branched podetia with obtuse apices, the axils scarcely dilated and destitute of rhizinae; f. SUBOBTUSATA Arn., similar to f. *obtusata* but with dilated axils provided with rhizinae.

16. C. BORYI Tuck. (*C. reticulata* (Russell) Wain.) In path, Upton Hill, Arlington Co., Va. (*Blake & Diehl*). The specimens belong to f. PROLIFERA Robbins, with podetia bearing short irregular adventitious branches. The species is so closely similar in appearance to *C. uncialis* that it has not seemed necessary to present a figure of it.

17. C. FLORIDANA Wain.; Robbins, RHODORA **29**: 136. *pl. 157.* 1927. (*C. Beaumontii* Wain. Act. Soc. Faun. Fl. Fenn. **10** (Monog. Clad. **2**): 455. 1894, as to descr., not as to name-bringing syn.)—PL. 211, F. 2.—Common at one locality in vicinity of Landover, near Bladensburg, Md., in sandy loam in clearing; collected also on a clayey bank near Lanham, Md. (*Blake*). The following nominal formae have been collected: f. TYPICA Robbins, fertile plants with squamulose podetia; f. ESQUAMOSA Robbins, fertile plants with esquamulose podetia; f. ELEGANS Robbins, sterile plants with squamulose podetia; f. BRACHIATA Robbins, sterile plants with esquamulose podetia.

18. C. DELICATA (Ehrh.) Floerke.—PL. 211, F. 3.—On decaying logs and stumps in woods, fairly common (*Williams, Miller, Blake*). Our plants are f. QUERCINA (Pers.) Wain., which is the normal form everywhere.

19. C. FURCATA (Huds.) Schrad.—PL. 211, F. 4.—On rocks or on ground in woods, often growing in moss; scarcer below the fall line (*Lehnert, Fink, Maxon, Miller, Blake*). The following varieties and forms occur: var. RACEMOSA (Hoffm.) Floerke, with esquamose podetia; var. RACEMOSA f. SUBCLAUSA (Sandst.) Evans, with essentially naked podetia having the sterile summits slightly expanded, subtruncate, with 2–5 spreading points, forming small pseudo-cups; and var. PINNATA (Floerke) Wain. f. FOLIOLOSA (Del.) Wain., with squamulose, subulate-tipped podetia. With the exception of specimens representing f. *subclausa*, the material of var. *racemosa* is intermediate between f. *corymbosa* (Ach.) Nyl. and f. *furcato-subulata* (Hoffm.) Wain.

20. C. squamosa (Scop.) Hoffm.—Pl. 211, f. 5.—Usually in sandy ground in pine woods or clearings, rarely on decaying logs or on rocks; common on the high ground between Bladensburg and Lanham, Md., not common elsewhere (*Miller, Blake*). A very variable species, the following forms being represented among local specimens: f. denticollis (Hoffm.) Floerke, with podetia cup-forming, decorticate, the upper half without squamules; f. squamosissima Floerke, similar but densely squamulose throughout with fine squamules; f. phyllocoma (Rabenh.) Wain., similar to the last but corticate and coarsely squamulose;[1] f. **sessilis** Robbins, n. f., with apothecia borne on the primary squamules, the podetia more or less abortive, bearing apothecia laterally as well as terminally (type from clayey bank on edge of woods near Lanham, Md., 6 Dec. 1925, *Blake*); f. levicorticata (Sandst.) Evans, with the podetia cup-forming, corticate, grayish, green often darkening, with or without squamules, represented by two modifications—m. rigida (Del.) Evans, frequently squamulose and with short, rigid, often radiate, terminal proliferations, and m. pseudocrispata Sandst., with well developed cups and smooth, short, often stout, whitish, esquamulose podetia; and f. turfacea Rehm, similar to f. *levicorticata*, but a dark, smooth-cortexed form of sunny situations.

21. C. caespiticia (Pers.) Floerke.—Pl. 211, f. 6.—Sandy ground, on banks and in woods (usually deciduous), rarely on logs, fairly common (*Fink, Miller, Blake*).

22. C. apodocarpa Robbins, Rhodora **27**: 211. 1925.—Pl. 211, f. 7.—Usually in sandy loam in deciduous woods, sometimes in clay or among rocks, rather common (*Blake*). Rarely found in this locality in fruit. The sterile thallus of erect brittle squamae, ashy-glaucous above and chalky white beneath, is readily recognized.

23. C. mitrula Tuck.—Pl. 211, f. 8.—On ground in fields and woods and on banks, rarely on stumps, very common (*Lehnert, Williams, Maxon, Fink, Miller, Blake*). All local specimens belong to f. imbricatula (Nyl.) Wain.

24. C. subcariosa Nyl.—Pl. 211, f. 9.—In old fields and woods, in sandy or clayey soil, sometimes among rocks, very common (*Lehnert, Williams, Miller, Blake*). The forms occurring are: f. evoluta Wain., with naked podetia; f. squamulosa Robbins, with squamulose podetia; f. epiphylla Robbins, with apothecia sessile on primary thallus; f. **pallida** Robbins, n. forma, with apothecia flesh-colored or whitish, and naked podetia (type collected on sandy slope in pine woods, vicinity of Landover, near Bladensburg, Md., 15 Feb. 1925, *Blake*).

25. C. polycarpia Merrill, Bryologist **12**: 46. *pl. 4, f. 4*. 1909.—Pl. 211, f. 10.—A single scanty collection from log in open woods, Great Falls, Va. (*Blake*).

[1] The three forms first mentioned are closely related, and by some authors the two last are treated as modifications of the first.

26. C. CLAVULIFERA Wain. in Robbins, RHODORA **26**: 145. 1924.—PL. 212, F. 1.—On ground in clearings or woods (usually deciduous), rarely on logs or among rocks, rather scarce (Washington, D.C.; vicinity of Landover, near Bladensburg, Md.: near Riggs Mill, Md.; Plummer Island, Md.; and Great Falls, Va., *Blake*). In addition to the typical form with naked podetia, f. SUBVESTITA Robbins, with squamulose podetia, has been collected.

27. C. ALPICOLA (Flot.) Wain. var. KARELICA Wain.—PL. 212, F. 2.—Known from our region only by two fruiting specimens collected by *Lehnert* in "District of Columbia," and mounted with others of *C. mitrula* and *C. subcariosa*. The plant grows on the ground in old fields.

28. C. PYXIDATA (L.) Fr.—PL. 212, F. 3.—On ground in woods and on rocks, scarce (*Fink, Blake*). Our plants belong to var. NEGLECTA (Floerke) Mass., represented by two forms; f. SIMPLEX (Ach.) Harm., with esquamose podetia, and f. LOPHYRA (Ach.) Rabenh., with squamose podetia.

29. C. CHLOROPHAEA (Floerke) Spreng.—PL. 212, F. 4.—On ground, often in moss, in deciduous or evergreen woods, and on banks and rocks, rarely on bases of trees; abundant (*Lehnert, Maxon, Fink, Miller, Blake*). The commonest and most variable Cladonia about Washington. The following named forms have been collected: f. **carneopallida** (Ach.) Robbins, n. comb.,[1] with pale flesh-colored apothecia (rare; collected once in its typical form, and once in a squamose state); f. SIMPLEX (Hoffm.) Arn., 1-ranked esquamulose sterile plants with decorticate surface of cups smooth and opaque; f. COSTATA (Floerke) Arn., similar but with decorticate surface of cups pellucid and more or less striate; f. PROLIFERA (Wallr.) Arn., like f. *simplex* but with the cups marginally proliferous, the secondary ranks mostly cup-forming; f. CENTRALIS (Flot.) Vain., like f. *costata* but with central proliferations; f. PTERYGOTA (Floerke) Vain., sterile squamulose plants; f. CARPOPHORA (Floerke) Anders, fertile esquamulose plants with distinct cups bearing sessile or short-stipitate podetia; f. HOMODACTYLA (Wallr.) Robbins, similar to the last but with indistinct cups and apothecia borne on long stipes; f. LEPIDOPHORA (Floerke) Sandst., with podetia fertile and squamulose.

30. C. CONIOCRAEA (Floerke) Sandst.—PL. 212, F. 5.—On ground, on bark, and on rocks, fairly common (*Lehnert, Miller, Blake*). Three forms occur: f. CERATODES (Floerke) Vain., with esquamulose, subulate-tipped podetia; f. TRUNCATA (Floerke) Vain., with esquamulose, truncate or obscurely cup-bearing podetia; and f. PHYLLOSTROTA (Floerke) Vain., with squamose podetia.

31. C. PITYREA (Floerke) Fr.—PL. 212, F. 6.—On old log, Plummer Island, Md. (*Fink*); on ground in low woods, near Great Falls, Va.

[1] *Cenomyce fimbriata* γ. *C. carneopallida* Ach. Syn. Lich. 258. 1814, in part. *Cladonia pyxidata* var. *chlorophaea* f. *carneopallida* Harm. "Lich. Lorraine 142"; Lich. Fr. 305. 1907.

(*Blake*); on old log near Chevy Chase, Md., mixed with *C. delicata* (*Blake*). The local material represents two forms—f. HOLOLEPIS (Floerke) Wain., with cup-bearing, more or less squamose or squamulose podetia, and f. SUBACUTA Wain., with cupless esquamose podetia—both belonging under var. ZWACKHII Wain.

32. C. MATEOCYATHA Robbins, RHODORA **27**: 50. 1925.—PL. 212, F. 8.—On banks in woods, scarce (*Lehnert, Miller, Blake*). In addition to the typical form, with esquamulose podetia, the f. SQUAMULATA Robbins, with podetia and margins of cups squamulose, has been collected.

33. C. VERTICILLATA (Hoffm.) Schaer.—PL. 212, F. 7.—On ground in woods and fields and on banks; well distributed, but often occurring in very small colonies (*Lehnert, Williams, Fink, Miller, Blake*). The following forms occur: f. EVOLUTA (Th. Fr.) Stein, with esquamulose podetia and proliferations only from the center of the cups; f. APOTICTA (Ach.) Wain., similar but proliferous from the sides of the podetia as well as from the center of the cups; f. PHYLLOCEPHALA (Flot.) Oliv., with squamulose podetia. Specimens from this region which have been identified as var. *cervicornis* (Ach.) Floerke appear to be only dwarfed plants of f. *evoluta*.

34. C. FOLIACEA (Huds.) Willd. var. ALCICORNIS (Lightf.) Schaer.—PL. 212, F. 9.—On rocks at Great Falls, in Maryland and Virginia (*Blake*). Found only in a sterile condition.

35. C. STREPSILIS (Ach.) Wain.—PL. 212, F. 10.—On ground, usually in sandy soil, in old fields and woods, sometimes on rocks, common (*Blake*). The three forms of this species named by Wainio have all been collected: f. GLABRATA Wain., with podetia developed and not squamose; f. CORALLOIDEA (Ach.) Wain., with well-developed, squamose podetia, by far the commonest form; and f. SUBSESSILIS (Wain.) Sandst., with podetia abortive.

36. C. PIEDMONTENSIS Merrill.[1]—PL. 212, F. 11.—Usually in sandy soil in or on the edge of pine woods, common (*Blake*). The following forms occur: f. OBCONICA Robbins, with stout naked obconical podetia and large terminal apothecia; f. SQUAMULOSA Robbins, like the last but uniformly squamulose; f. PHYLLOCOMA Robbins, with clavate or cylindric squamulose podetia and biform apothecia, some medium-sized, terminal, and solitary, some minute and densely clustered, axillar as well as terminal; and f. LEPIDIFERA (Wain.) Robbins, with cylindric squamulose podetia with reduced apical squamules, and the tips expanded and divided into numerous short, subradiate, freely minute-fruited segments.

Explanation of Plates 210–212

(Except where otherwise indicated, all the figures represent specimens collected in the District of Columbia or vicinity by S. F. Blake. All the figures are natural size.)

[1] See Robbins, RHODORA **31**: 101–106. *pl.* 187. 1929.

Figs. 1–11, Cladonia, subg. Cenomyce, ser. Ochrophaeae, subser. Clausae.

PLATE 210. FIG. 1. *Cladonia rangiferina* f. *crispata.* FIG. 2. *C. impexa* (toward f. *laxiuscula*). FIG. 3. *C. tenuis.* FIG. 4. *C. sylvatica* f. *sphagnoides.* FIG. 5. *C. mitis,* a typical little-branched form (Wareham, Mass., *Robbins*). FIG. 6. *C. papillaria* f. *molariformis* (upper and right-hand specimens) and f. *papillosa* (lower specimen). FIG. 7. *C. vulcanica* f. *minor* (District of Columbia, *Lehnert*). FIG. 8. *C. floerkeana* var. *intermedia* (Dumbarton, Scotland, *Blake*). FIG. 9. *C. bacillaris* f. *clavata* (two specimens). FIG. 10. *C. macilenta* f. *styracella.* FIG. 11. *C. coccifera* var. *stemmatina* (poorly developed plants). FIG. 12. *C. pleurota* f. *decorata* (three specimens). FIG. 13. *C. paludicola.* FIG. 14. *C. cristatella* f. *vestita* (upper specimen) and f. *Beauvoisii* (lower specimen).

PLATE 211. FIG. 1. *C. uncialis* f. *dicraea* (left-hand specimen; young plant) and f. *obtusata* (right-hand specimen) FIG. 2. *C. floridana* (four specimens; the two left-hand ones f. *typica,* the upper right-hand one typically developed f. *elegans*). FIG. 3. *C. delicata* f. *quercina* (Stoughton, Mass., *Blake*). FIG. 4. *C. furcata* var. *pinnata* f. *foliolosa* (left-hand specimen) and var. *racemosa* (right-hand specimen). FIG. 5. *C. squamosa* f. *squamosissima* (left-hand specimen) and m. *rigida* (two right-hand specimens; atypical). FIG. 6. *C. caespiticia.* FIG. 7. *C. apodocarpa* (thallus). FIG. 8. *C. mitrula* f. *imbricatula.* FIG. 9. *C. subcariosa* f. *evoluta* (two specimens). FIG. 10. *C. polycarpia.*

PLATE 212. FIG. 1. *C. clavulifera* (four specimens, all but the third one representing f. *subvestita*). FIG. 2. *C. alpicola* var. *karelica* (Sharon, Mass., *Robbins & Blake*). FIG. 3. *C. pyxidata* var. *neglecta* f. *simplex* (two specimens). FIG. 4. *C. chlorophaea.* FIG. 5. *C. coniocraea* f. *ceratodes* (upper specimen) and f. *truncata* (lower specimen). FIG. 6. *C. pityrea.* FIG. 7. *C. verticillata* f. *evoluta.* FIG. 8. *C. mateocyatha* (two specimens, the right-hand one f. *squamulata;* Wareham, Mass., *Robbins*). FIG. 9. *C. foliacea* var. *alcicornis* (thallus). FIG. 10. *C. strepsilis* f. *coralloidea.* FIG. 11. *C. piedmontensis* (the lower right one f. *lepidifera,* the two others slender plants of f. *obconica*).

SOLIDAGO AND ASTER IN WASHINGTON COUNTY, MAINE

CLARENCE HINCKLEY KNOWLTON

SEVERAL of my recent vacations have come at the latter end of the summer, and have taken me to Washington County in extreme eastern Maine, when the Asters and Goldenrods were at their prime. The assortment of species and varieties and their relative abundance is quite different from conditions in other parts of New England, and are therefore of considerable interest. In addition to many previous observations I took special pains to check stations in various parts of the county in the years 1928 and 1929. There are still large areas of woodland in the northern part of the county which have never met the eye of the botanist, but the list given seems to be fairly adequate for the coastal strip and the organized towns between the sea and the forest.

I have included collections made by other botanists, notably G. G. Kennedy, Kate Furbish, M. L. Fernald, K. M. Wiegand and S.

N. F. Sanford. These are included in the herbaria of the New England Botanical Club, Boston Society of Natural History, Gray Herbarium, and Mr. Sanford's own herbarium. My own collection includes a great many of these Washington County plants, also.

Solidago latifolia L. Rich woods, deciduous, Cooper. On Lead Mountain in Township No. 28, Hancock County, there is a great abundance of this, growing at 2000 feet elevation and above. This township borders on Washington County.

S. bicolor L. Frequent in dry sunny places.

S. macrophylla Pursh. This is a typical plant in the Canadian spruce forest near the sea, at Lubec, Cutler and Roque Bluffs. It is associated with *Thelypteris spinulosa* (O. F. Mueller) Nieuwl., var. *americana* (Fischer) Weatherby, and *Aster acuminatus* Michx., just as in the mountainous regions of western Maine, New Hampshire and Vermont. It often grows close down to the high-tide level on the shore. When the woods are cut away, as I have noted recently at Lubec and at Roque Bluffs, the ferns are stunted by the sun, while the two composite plants find new food supplies in the bared humus, and grow with great luxuriance. I have seen *S. macrophylla* a meter in height, with a big thyrse of very large flowers, under these conditions. At Roque Bluffs in 1928 I saw a clearing of two or three acres filled with these two species in flower, a most beautiful sight.

S. puberula Nutt. Very common in open spruce woods near the sea, especially on headlands, as well as in dry sunny places inland.

S. sempervirens L. Edges of salt marshes and wet seashore, all along the coast, very common.

S. juncea Ait. This species, so common and familiar in many other parts of New England, is one of the rarities in Washington County. I have noted it in but one place, a dry bank in the city of Calais.

S. uniligulata (DC.) Porter. This is one of the most characteristic plants of the county. It varies in size from large specimens 6 dm. high growing in rich moist soil to the tenuous little plants of the peatbog not over 2 dm. tall. The axis and branches of the inflorescence are almost as yellow as the flowers.

S. rugosa Mill. Moist thickets, exceedingly common throughout.

S. rugosa Mill., var. villosa (Pursh) Fernald. The same habitat as the species; found at Roque Bluffs, Machias, Machiasport, Cutler, on the coast, and at Wesley inland.

×S. asperula Desf. After much search along the shore at East Machias, where both *S. rugosa* and *S. sempervirens* flourish, I found a few scattered plants of this interesting hybrid, Sept. 5, 1929. One queer specimen looked like a hybrid of *S. sempervirens* with *S. nemoralis*.

S. nemoralis Ait. Dry soil, very common and abundant.

S. canadensis L. Moist thickets, fields and pastures, common.

S. SEROTINA Ait. This is a rare species in the county. I found it in only one place, at Marshfield, in moist rich soil by the roadside, Sept. 7, 1929.

S. GRAMINIFOLIA (L.) Salisb., var. NUTTALLII (Greene) Fernald. Moist soil, especially in clay, very common throughout.

ASTER MACROPHYLLUS L. Rich open woods, frequent. The form with minute glands in the inflorescence which has been called var. IANTHINUS (Burgess) Fernald seems to be about as abundant as the strongly glandular form which is the type.

A. MACROPHYLLUS L., var. VELUTINUS Burgess. Open woods, at Roque Bluffs, Trescott, Perry and No. 14 Township.

A. RADULA Ait. Swamps and heaths in rich soil, common. A beautiful species.

A. RADULA Ait., var. STRICTUS (Pursh) Gray. Damp heath, Boot Cove, Lubec (*M. L. Fernald*, Aug. 2, 1909); Cutler (*Kate Furbish*, July 25, 1902).

A. UNDULATUS L. Cutler (*Kate Furbish* in 1902).

A. CORDIFOLIUS L. This species, so common elsewhere, is rare in Washington County, occurring as a dooryard weed in Machias, Machiasport and Lubec.

A. LINDLEYANUS T. & G. Moist fields and roadsides; not noted near the shore, but frequent and often abundant in the settled towns from Beddington and Cherryfield east to Calais (ten stations noted). At its best this is a very handsome species.

A. VIMINEUS Lam., var. DUBIUS Wiegand. Blueberry plain, Beddington, Sept. 2, 1924. Specimen in herb. N. E. Botanical Club, determined by K. M. Wiegand.

A. LATERIFLORUS (L.) Britton. Moist soil, very common and abundant. All the material gathered seems to be of the typical form, according to Wiegand's recent revision (RHODORA xxx. 161, 1928), but var. *angustifolius* Wiegand has been collected in Hancock county near the line, and is undoubtedly occasional in the Washington County towns.

A. PANICULATUS Lam. Roadsides and moist open places, very common.

A. PANICULATUS Lam., var. BELLIDIFLORUS Burgess. This densely-flowered narrow-leaved variety as described in Gray's Manual, 7th ed., is occasional. I have noted it in abundance at five stations.

A. JUNCEUS Ait. River meadow, Princeton (*M. L. Fernald*, July 22, 1909).

A. LONGIFOLIUS Lam. Cutler and Lubec (*Kate Furbish*, 1902); coastal strand, Moose Island, Eastport (*M. L. Fernald*, 1909).

A. NOVI-BELGII L. Moist soil, common, especially near the coast. A very vigorous much-branched form is frequent in the rich soil at the extreme landward margin of the salt marshes.

A. NOVI-BELGII L., forma ALBIFLORUS Rand & Redfield. Barrier beach, Roque Bluffs.

A. novi-belgii L., var. litoreus Gray. Edges of salt marshes and seashore, occasional.

A. puniceus L. Swamps, very common throughout. This is the plant with the large, vivid, pale-blue flowers. A beautiful pink form was found in rich soil by the road in Edmunds, Sept. 9, 1929.

A. umbellatus Mill. Moist soil, very common throughout. There are hundreds of acres covered with this aster, which often grows to a height of 15 dm. It is the most conspicuous species of the group, with beautiful cream-white flowers in mid-August.

A. acuminatus Michx. Woods and clearings, very common.

A. nemoralis Ait. Boggy meadows and peat bogs at Roque Bluffs, Cutler, and Wass Island; stony edge of Bog Lake, Northfield (*M. A. Barber*, Aug. 27, 1898; *C. H. Knowlton*, Sept. 7, 1929).

A. nemoralis Ait., var. major Peck (var. *Blakei* Porter). Edge of peat bogs, Roque Bluffs and East Machias.

Hingham, Massachusetts.

A NEW STATION FOR CALLUNA

E. W. Littlefield

On May 18, 1930, while inspecting some state plantations on the "Mountain Pond" area in Franklin County, New York, in company with Mr. E. J. Eliason, the writer discovered a patch of the European Heather (*Calluna vulgaris*, Hull). This plant formed a mat about a square yard in extent on the south edge of a plantation of Scotch pine (*Pinus sylvestris*, L.) located along the so-called "Slush Pond Road" in the town of Brighton (Twp. 18, Great Tract # 1, Macomb's Purchase), about three miles north of "Paul Smith's".

The occurrence of this species so far out of its known range and in an area which has for many years been wild forest land was thought sufficiently unusual to put on record, and a specimen was accordingly submitted to Dr. Homer D. House, State Botanist, who confirmed the identification. According to House's "Annotated List"[1] only one verified report of the occurrence of *Calluna* in New York State has been made previously. This was from Rensselaer County, quite outside the Adirondack region. Reports of the establishment of *Calluna* at two stations in the central part of the State, one in Oneida and the other in Herkimer County, have never been substantiated, though according to Dr. House there is some historical evidence to support the claim made in Paine's "Catalogue" (1865) that plants were actually brought into those localities from Massachusetts.

[1] N. Y. State Mus. Bull. **254**: 551–2. 1924.

The Mountain Pond area, referred to above, is the site of some of the earliest reforesting projects carried on by the state. The particular plantation of Scotch pine near which the *Calluna* was found was set out in 1908, from stock grown in the state nurseries. A short distance west of this, however, in 1905, there were planted some 300,000 white pine (*P. Strobus*, L.) imported from nurseries at Halstenbeck, Germany. On other parts of the tract, also, a considerable amount of sowing was done, in 1905 and 1906, with various forest tree seeds, including both Scotch pine and Norway spruce. The presence of the *Calluna* along the road which affords the principal if not the only means of access to the tract from the main highway suggests the possibility that its seeds may have been distributed there during some of the operations referred to above.

In certain other instances where European heaths have become established in North America, notably at Nantucket, Mass.,[2] and in New York State (loc. cit.) its introduction has been associated with importations of forest trees from northern Europe.

In the present case, the imported white pine stock of German origin would appear to have been the logical agent in the bringing of *Calluna* on to the area. Whether the Scotch pine and Norway spruce seed used in the sowing operations could have been instrumental in this regard seems more problematical. A systematic search among both seeded and planted areas, as well as among other plantations of imported stock in the same region, might disclose other patches of *Calluna* which would throw further light on this question.

Conservation Department,
Albany, New York.

Coronilla varia in Michigan.—I have a small summer home on Lakeville Lake in the northeastern section of Oakland County, Michigan. For several years I have been informed from time to time by different residents of the vicinity that a Mr. Potter, who lives on the outskirts of the Village of Lakeville, had growing in his yard a "strange clover or vetch," and knowing my interest in botany, it was stated that some of it would be brought to me for identification. However, it was not until June of last summer that Mr. Potter brought to my place specimens of the plant. While I had botanized the locality

[1] Rhodora **10**: 173–179. 1908; Bull. Torr. Bot. Club **41**: 415–16. 1914.

more or less thoroughly for a number of years and am fairly familiar with the Michigan flora I had never seen the plant. Consulting Gray's *Manual* I found it to be *Coronilla varia* L. which it is stated has a range from "New England to New Jersey." Mr. Potter informed me that he had found the plant growing in a meadow not far from Lakeville, and as the plant and flower were so unusual he had transplanted some of it to his yard where it had flourished. He said that to his knowledge it had been growing in the meadow fifteen years. I subsequently visited the place and found the plant which had evidently been introduced through seeding. It had spread so that it occupied a more or less circular patch approximately thirty feet in diameter. The meadow is hilly and the soil a gravel-clay-sand mixture. The colony of *Coronilla* is growing in a broad valley near the boundary line of the field. The plant is not listed in Beal's *Michigan Flora* and inquiry at the herbaria of the Michigan State College and the University of Michigan developed the fact that it has not heretofore been reported from Michigan.—Cecil Billington, Detroit, Michigan.

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JOURNAL OF

THE NEW ENGLAND BOTANICAL CLUB

Vol. 33. August, 1931. No. 392.

NOTES ON SOME NEW YORK PLANTS

W. C. Muenscher and Bassett Maguire

(Plate 213)

During the summer of 1930 the writers had an opportunity to make observations on the distribution of a number of the less common plants in several localities, chiefly in northern New York. Notes are here recorded on a few of the collections made which appear to represent additions to the known flora of New York State, or because they extend our knowledge concerning the distribution of some species in the State.

Alisma Geyeri Torr. Mostly submerged in shallow water. Rather common in silt overlying bedrock along the St. Lawrence River: Chimney Island, Ogden Island, Waddington and Polly's Gut, St. Lawrence County; near the mouth of the St. Regis River, Franklin County. Previously reported from near Ogdensburg and Chaumont, Jefferson County.[1]

Rumex Acetosa L. This weed has been naturalized in a number of localities in New York. In Cortland and Broome Counties, in the valley of the Tioughniouga River, it is very abundant, especially between Blodgetts Mills and Whitney Point, a distance of about 20 miles. In early June many of the permanent or old meadows along this river appear reddish on account of the abundance of this weed.

Lychnis Flos-Cuculi L. Occurring as a weed in a clover field east of Marathon, Cortland County. In other localities in the State where this has become naturalized it occurs chiefly in moist meadows.

Erucastrum gallicum (Willd). Schulz. A weed on waste ground near the dock in Plattsburg, Clinton County. Before 1920 this weed was known in this state only from Tompkins County. Since then the senior author has collected it in Cayuga County (1925), Livingston County (1926) and Erie County (1928).

Subularia aquatica L. This little submerged plant was found in fruiting condition in 3 to 7 decimeters of water off the north end of

[1] Fernald, M. L. and K. M. Wiegand. Rhodora 25: 205-214. 1923.

Piseco Lake, Hamilton County. Collected by *O. F. Curtis and L. H. MacDaniels*, October 11, 1930. Apparently not previously recorded from New York State.

Podostemon Ceratophyllum Michx. Forming a dense mosslike growth, attached by fleshy disc-shaped processes to rocks on the bottom of very swiftly running streams: rapids of the Grass River; below Massena, St. Lawrence County; rapids of St. Regis River below Hogansburg, in cascades of Chateaugay River below Chateaugay Chasm, Franklin County (Plate 213). Previously reported[2] only from Watertown (Gray, 1843), Newburgh (Halsted, 1843), and Oneida County (Haberer, 1905). This plant is apparently not as rare in New York State as the previous collections indicate; the inaccessibility of its habitat, in very swiftly running water, probably accounts for the few collections made. In the St. Regis River station the river had been diverted temporarily on account of some construction work for a power canal, so as to expose the bed rock. Between 2 and 3 acres of the river bottom were covered with almost a solid mat of Podostemon. The plants were mostly past the flowering stage, but fruits were abundant.

Euphorbia Cyparissias L. The production of seeds by this naturalized weed has been considered of rare occurrence.[3] In about 40 stations where this species was examined by the senior author, seeds were found in only three: along a roadside bank west of Potsdam, St. Lawrence County; on a sandy bank beside Bay Pond, Franklin County; on several adjoining farms between Cedarville and Columbia Center, Herkimer County. At the last station this species is a troublesome weed on at least 80 acres on one farm, not to mention the adjoining farms.

Hippuris vulgaris L. The submerged form was found associated with *Potamogeton pectinatus* L., *P. Richardsonii* (A. Benn.) Rydb. and *Vallisneria americana* Michx. in 1 to 3 meters of water in the St. Lawrence River; below Ogdensburg; Waddington, St. Lawrence County; between the mouths of the Raquette and St. Regis Rivers, Franklin County. Also in mud near shore in the last two localities. No flowers or fruits were found. Reported as infrequent across the northern part of the State.

Myriophyllum Farwellii Morong. Specimens with fruits answering the description of this species were common in shallow water in Bradley Pond, Clinton County.

Odontites rubra Gilib. In sandy soil along roadside and in a field near a cemetery east of Chateaugay, Franklin County. Naturalized from Europe in northeastern Canada and Maine. Apparently not recorded previously from New York State.

Ambrosia psilostachya DC. This western weed was found well established over several acres in dry sandy fields and along both

[2] House, H. D. New York State Museum Bulletin 254: 375. 1924.

[3] Deane, W. Rhodora 12: 57–61. 1910.

Podostemon Ceratophyllum on Bed of St. Regis River

sides of the highway just north of Lake Clear Junction, Franklin County. Previously reported from Rochester.[1]

ARTEMISIA PONTICA L. This introduced plant was growing in a sandy pasture near Brasher Center, St. Lawrence County, forming solid clumps varying from 2 to 5 meters across and producing numerous panicles of flower heads. Ordinarily this species does not flower.

CIRSIUM ARVENSE (L.) Scop. var. VESTITUM Wimm. & Grab. A thistle answering the description of this variety has been common over about 5 acres of an abandoned field near Danby, Tompkins County. It was first observed in 1928. Only pistillate flowers are produced, suggesting that the entire colony probably was developed by vegetative propagation from a single plant.

HELIANTHUS MAXIMILIANI Schrad. Two large clumps of this western sunflower were found on waste ground near the upper end of the Massena Power Canal, St. Lawrence County.

IVA XANTHIIFOLIA Nutt. Growing luxuriantly about farm buildings and along the roadside near Massena Center, St. Lawrence County.

LEONTODON AUTUMNALIS L. Common in several meadows about 3 miles southwest of Malone, Franklin County.

MADIA SATIVA (Nutt). T. & G. In waste ground and in new grass seeding near the Power Plant, Massena, St. Lawrence County. Several large viscid-glandular plants nearly 1 meter high, with large heads capitate-congested at the ends of branches but with mature achenes. Probably referable to the var. CONGESTA T. & G. Common along the Pacific Coast where it is thought to have been naturalized from Chile. Apparently not previously reported from New York State.

Specimens of all of the collections recorded in these notes have been deposited in the herbarium of Cornell University.

CORNELL UNIVERSITY.

EXPLANATION OF PLATE 213

The bed of St. Regis River below Hogansburg, New York, exposed while the water was diverted through a power-canal. The dark moss-like carpet is *Podostemon Ceratophyllum.*

FURTHER ADDITIONS TO THE CONNECTICUT FLORA

EDWIN H. EAMES

THE following notes and records supplement the "Additions" published as Bulletin 48, Conn. Geol. and Nat. Hist. Survey, Jan., 1931, and unless otherwise stated are to be credited to the writer.

[1] House, H. D. New York State Museum Bulletin 254: 1924.

Lesser items may better form part of a composite publication in the future. Records new to the State are preceded by an asterisk if native, by a dagger if introduced.

*POLYSTICHUM ACROSTICHOIDES (Michx.) Schott, f. **orbiculatum**, n. f., pinnis plerumque omnino vel fere orbicularibus, dentatis. Pinnae orbicular or nearly so, dentate. Darien, Fairfield County, 8 Oct., 1930, on a lightly wooded rocky hillside with normal plants, no. 11214 (TYPE in Gray Herbarium). Typical fronds are 14–20 mm. broad, 15–30 cm. long. Most fronds show some more or less transitional pinnae which usually are irregularly disposed.

LYCOPODIUM ALOPECUROIDES L. In addition to the station in Milford, this has been found in Fairfield where it formed a colony near a large area of *L. inundatum* L. and a tall slender form of var. *Bigelovii* Tuck. and without any intergradations.

*POTOMAGETON MICROSTACHYS Wolfg., var. SUBELLIPTICUS Fernald (RHODORA **32**: 82. 1930) occurs in Taunton Pond, Newtown, Fairfield County, where it was collected just after flowering 13 Aug., 1930, no. 11150 in Herb. Eames. This variety is not otherwise reported south of northern Vermont and the Adirondacks.

*SCIRPUS LINEATUS Michx., f. **elongatus**, n. f., spiculis elongatis, 12–18 mm. longis. Spikelets elonagted, 12–18 mm. long. Sharon, Litchfield County; also in New York at Southeast, Putnam County, 27 July, 1928, *Eames and Starr*, no. 10672 (TYPE in Herb. Eames). In this species spikelets rarely exceed 10 mm., but in these collections the plants are attractively different.

*ARISAEMA PUSILLUM (Peck) Nash, f. **pallidum**, n. f., spatha spadiceque omnino pallide viridibus. Spathe and spadix pale green throughout. Fairfield, 17 June, 1907, open sphagnum swamp bordering tidal meadows, no. 5646 (TYPE in Herb. Eames). Many plants about the border of a large colony of the normal dark-colored type.

*CORALLORRHIZA ODONTORRHIZA (Willd.) Nutt., f. FLAVIDA Wherry. Lip white, unspotted; plant otherwise greenish yellow throughout. Easton, Fairfield County, 20 Sept., 1928, rocky openly wooded slope, *W. I. Starr* (in Herb. Eames). This was examined while fresh. It is analagous to a form of *C. maculata* Raf.

This affords opportunity to note the occurrence of a branched phase of the typical form along a wood-border in Fairfield, 8 Sept., 1903, nos. 4078, 4079. In two straggling disconnected colonies were many plants each with one flowering branch from the uppermost bract. These branches each had a well-formed exserted bract and a small spike of flowers. The form was dominant in each area:

*SALIX PETIOLARIS J. E. Smith, occurs in a boggy swamp in Danbury, with *S. serissima*, *S. candida* and a sparse representation of *S. candida* var. *denudata* Anders. which is otherwise known in Connecticut only from Salisbury.

*DICENTRA CUCULLARIA (L.) Bernh., f. **purpuritincta,** n. f., corolla rosea, flexura saturate aurantiaca, calice rubescenti-purpureo. Corolla pink, deep orange at flexure; calyx reddish purple. Westport, Fairfield County, 20 April, 1928, in rich deep soil of moist wooded slope, *Eames and Starr*, no. 10561 (TYPE in Herb. Eames). This form occurs at a number of stations in southwestern Connecticut, nearly always in colonies of the typical form into which it grades. The purple coloration strongly pervades scape and appendages.

*SAXIFRAGA VIRGINIENSIS Michx., f. **plena,** n. f., floribus multiplicibus, albis. Flowers double, white. Kent, Litchfield County, 3 May, 1908, on a ledge with several similar plants, *Hugh Mosher* (TYPE in Gray Herbarium). Double-flowered plants have been reported from Woburn, Massachusetts and from Pennsylvania by Meehan[1] and by Sterns.[2] Leggett[3] reported it from Greenburg, Westchester County, New York.

†SPIRAEA HYPERICIFOLIA L. forms a large and evidently long established colony on a dry, open, rather barren roadside in Brookfield, Fairfield County. Pursh knew this species in "Can. and N. Y." and Muhlenberg from "N. Y.," according to Beck.[4]

*LUPINUS PERENNIS L., f. ROSEA Britt. occurs in several colonies of the typical form in Brookfield, also in Danbury.

†WISTERIA FRUTESCENS (L.) Poir. has spread freely over a considerable area on West Rock, New Haven, where it has been planted along a roadway.

†PARTHENOCISSUS TRICUSPIDATA (Sieb. & Zucc.) Planch. is rare or occasional in wastes and on banks in the southwestern part of the State. Starlings eat the fruit and may be responsible for its dissemination, at least in part.

*VIOLA SORORIA Willd., f. BECKWITHII House, with white petals, occurs plentifully in a colony, essentially all of this form in its purity, in Kent.

†TEUCRIUM BOTRYS L. Dry rocky bank, in limestone soil, at Kent. Local and rare.

†SATUREJA ACINOS (L.) Scheele. Dry upland pasture, Sherman, Fairfield County.

*PENTSTEMON HIRSUTUS (L.) Willd. f. ALBIFLORUS Farwell. Flowers white; stem and leaves green. Kent, with the typical form, which usually is strongly suffused with purple throughout, no. 10225, 22 June, 1927.

*CASTILLEJA COCCINEA (L.) Spreng., f. LUTESCENS Farwell. Upper part of floral bracts and tip of sepals yellow; plants otherwise pale green throughout. Sherman, Fairfield County, 10 May, 1903, *Austin and Eames*. Though rather rare or local, this form is widely dis-

[1] Am. Nat. Aug. 1872 & 1877, also in Native Fl. & Ferns 1: 76. 1878.

[2] Bull. Torr. Cl. 14: 122. 1887.

[3] Bull. Torr. Cl. 3: 39. 1872.

[4] Bot. N. & Mid. States, 99. 1833.

tributed, usually in colonies with the type. Also in eastern New York, where also a transition state, pale salmon in color, has been collected at South Salem by *W. I. Starr* (Herb. Eames).

†Galium verum L., f. albidum (Hartm.) Lindm., in which the flowers are of palest yellow, was plentiful with the typical form in grassland at one locality in Stratford and in a meadow at Wilton, Fairfield County.

†Galium Mollugo L., f. ochroleucum Koch. Flowers pale yellow, brighter in bud. Grassy hillside, Bethel, Fairfield County, forming a large clump, 20 June, 1929, no. 10932.

† × Galium ochroleucum Wolff. (*G. Mollugo × verum*). With its pale yellowish flowers this hybrid was found in several colonies in an extensive meadow at Wilton, Fairfield County, with both parents, 30 June, 1930, no. 11099.

†Sambucus nigra L. Several large shrubs, long persistent, on waste land in Bridgeport.

†Rudbeckia hirta L., f. viridiflora S. H. Burnham. Several plants in a dry old pasture, New Fairfield (*W. I. Starr*).

†Guizotia abyssinica Cass. Found sparingly along a roadside in Westport in 1927 and a small number of bushy plants scattered over a tract of waste land in Bridgeport in 1930. It flowered abundantly at the latter station but was killed by frost without having matured any seeds, indicating a precarious existence which must have been more favorable in other years. Native of southwestern Asia and northeastern Africa.

†Sonchus arvensis L., var. glabrescens Gunth., Grab. and Wimm. Abundant in a wet meadow, Redding, Fairfield County.

I am greatly indebted to Mr. C. A. Weatherby for assistance in the identification of doubtful plants in this list.

Bridgeport, Connecticut.

The Occurrence of Phragmites communis in western Washington and Oregon.—The reed, *Phragmites communis*, occurs only in scattered localities in western Washington and Oregon. The writer had been engaged in field work in Washington for twenty years when, in July, 1929 (in company with Dr. A. P. Dachnowski-Stokes), he first found this plant growing west of the Cascade Mountains.

At this time a vigorous patch of this plant, covering an area about 500 by 100 feet, was found growing along Mercer slough east of Lake Washington and only a few miles from Seattle. Peat formed by this reed was found in the cultivated area bordering this patch of growing

plants. Lake Washington and the waters of this slough were lowered seven feet in 1916 at the time of the opening of the ship canal, and the growth of this plant in this place had evidently been more extensive before the lowering of the water level.

Specimens were collected at this place by the writer in August, 1929, and these have been identified at the U. S. National Herbarium, the Missouri Botanical Garden, the New York Botanical Garden, and the Field Museum of Natural History. A specimen has been deposited at each of these places and also in the herbarium at the Museum of the University of Washington. It was found that there was already a specimen in this herbarium collected at "Lake Washington" October, 1916, by Mr. Kahan.

Correspondence and consultation with other botanists has brought out the fact that it has been collected at two other places in western Washington (Ilwaco, 1885, and Lake Ozette, 1927) and at four places in western Oregon (Sauvies Island, 1877; Blind Slough, Clatsop County, 1903; Brooks, Marion County, 1922; Lake Labish, 40 miles south of Portland, 1929).

Mr. W. N. Suksdorf, of Bingen, Washington, who has collected plants in the state for more than forty years, writes that he has never collected this species west of the Cascades. He states that the plant formerly occurred at Bingen but disappeared years ago as the land was brought into cultivation, and that he knows of only one place (8 miles west of Bingen) where it is abundant now.

Mr. J. B. Flett, who has also collected in Washington for many years, writes that he has never seen this species in western Washington.

The experience of these two botanists and of the other botanists who have kindly contributed information confirms the experience of the writer and indicates that this reed has played a much smaller part in the development of plant communities in western Washington and Oregon than it has in many other parts of North America.—GEORGE B. RIGG, University of Washington, Seattle.

PLANTAGO ARENARIA W. & K. AT PORTLAND, MAINE.—In September 1929, the writer found a single plant, about two feet tall, of *Plantago arenaria* growing on an extension of Hersey Street in Portland. In the spring this part of the street had been filled with material

scraped from other streets nearby, though it was not possible to learn more definitely of the places from which the material had been taken. A hundred and more feet away from the plant, a gulley was being filled with discarded packing cases, automobiles and other matter; no plants were seen in that section.

The plant mentioned was flowering abundantly and producing seed. In the season of 1930, about a dozen of the plants reached maturity within an eight-foot circle of the original plant, but none were found farther away. These flowered profusely and bore seed.

This plant seems to require a long season, not flowering until late summer or early fall. On November 15 it was observed that many seeds had matured, yet many capsules contained unripe seeds, and the fleshy leaves had been withered by the freezing nights of the first week of the month. The large, shining dark brown seeds (two in number) would seem likely to offer choice morsels to seed-eating birds.

The success or failure of this pioneer, in its attempt to establish itself in this region will be watched with interest for the next few years. —Arthur H. Norton, Portland Society of Natural History.

THE GENUS GEUM IN THE ATHABASCA-GREAT SLAVE LAKE REGION[1]

Hugh M. Raup

Recent botanical surveys in the Athabasca-Great Slave Lake district have yielded a number of specimens of *Geum* which are not determined easily, and which seem to warrant a somewhat critical examination of the genus as it is there represented. The writer's collections may be divided into three groups, the two smaller of which are clearly *G. strictum* Ait. and *G. triflorum* Pursh. The largest group, involving 18 numbers and 58 sheets, is equally well-defined, but consists of plants with their upper stem-leaves considerably reduced and their basal leaves supplied with a large, ovate to cordate terminal leaflet after the manner of *G. macrophyllum*. Further characteristics of these plants are pale yellow obovate petals, receptacles loosely covered with very short hairs but not covered so as to obscure the rather elongated pits, the lower internodes of the styles loosely supplied with

[1] Published by permission of the Director of the National Museum of Canada, and during the writer's tenure of a National Research Fellowship in the Biological Sciences.

minute stalked glands, and the calyces and peduncles of the flowers and fruits with small stalked glands interspersed among the abundant short hairs. The plants are most common on meadow shores of lakes and streams and in upland semi-open prairies.

The specimens in question match closely in all of the above characters those in the Gray Herbarium labeled by Rydberg *G. oregonense* (Scheutz) Rydb., and also the type and several characteristic specimens of *G. perincisum* Rydb. loaned to the writer from the Herbarium of the New York Botanical Garden. After study of his own material and that just mentioned the writer has been unable to separate these two species. The serration of the leaflets and the shape ("rounded or reniform" vs. "rhombic, ovate, or subcordate") of the terminal leaflet of the basal leaves, used by Dr. Rydberg[1] as definitive characters do not appear reliable, especially in a group where leaf form is so notably variable.

The name *oregonense* was first used by Scheutz[2] in naming a fragmentary specimen from the Oregon region of North America. He considered it a subspecies of *G. urbanum* L., a European species which is now known to occur only as an introduction in eastern North America. Rydberg[3] assumed this fragment to be identical with some of his undetermined northwestern specimens and accordingly named them *G. oregonense*. Since the specimen cited by Scheutz consists of only the upper parts of the stems and has no mature fruits, some character other than those commonly used became necessary before it could be adequately separated from its near affinities. Rydberg[4] uses for this the shape of the upper stem leaves and the form of the inflorescence, neither of which appears to suffice in the material at hand. The tendency toward reduction and increased dissection of the upper stem leaves may be found in typical eastern *G. macrophyllum*, especially in specimens from the northern parts of the range. The form of the inflorescence is also extremely variable in typical *G. macrophyllum*, depending upon the age of the plant and its habitat. In all of the material, however, the presence of minute stalked glands on the peduncles has served to separate the specimens in question from *G. macrophyllum* which is without such glands. Dr. Gunnar Samuelsson, at Stockholm, has very kindly examined the original specimen cited

[1] Rydberg, P. A. *North American Flora* xxii. 402 (1913).
[2] Scheutz, N. J. *Prodr. Monogr. Georum* 26 (1870).
[3] Rydberg, P. A. Bull. Torr. Bot. Club xxv. 56 (1898).
[4] Rydberg, P. A. *North American Flora* xxii. 401 (1913).

by Scheutz, and states that the sheet contains four flowering tops, one with young fruits, collected by Captain Waerngren. He also compared it with two specimens apparently corresponding to *G. oregonense* Rydberg. The latter showed very prominent stalked glands, while on the Waerngren specimen these were completely lacking. Dr. Samuelsson states that the fragments are not from *G. strictum* and expresses the opinion that they are from *G. macrophyllum*.

The type-specimen of *G. perincisum* Rydb.[1] was collected by W. C. McCalla at Banff, Alberta, and as stated above matches the writer's material as well as that labeled *G. oregonense*. The question whether *perincisum* constitutes a species, however, requires further analysis before the name may be properly applied.

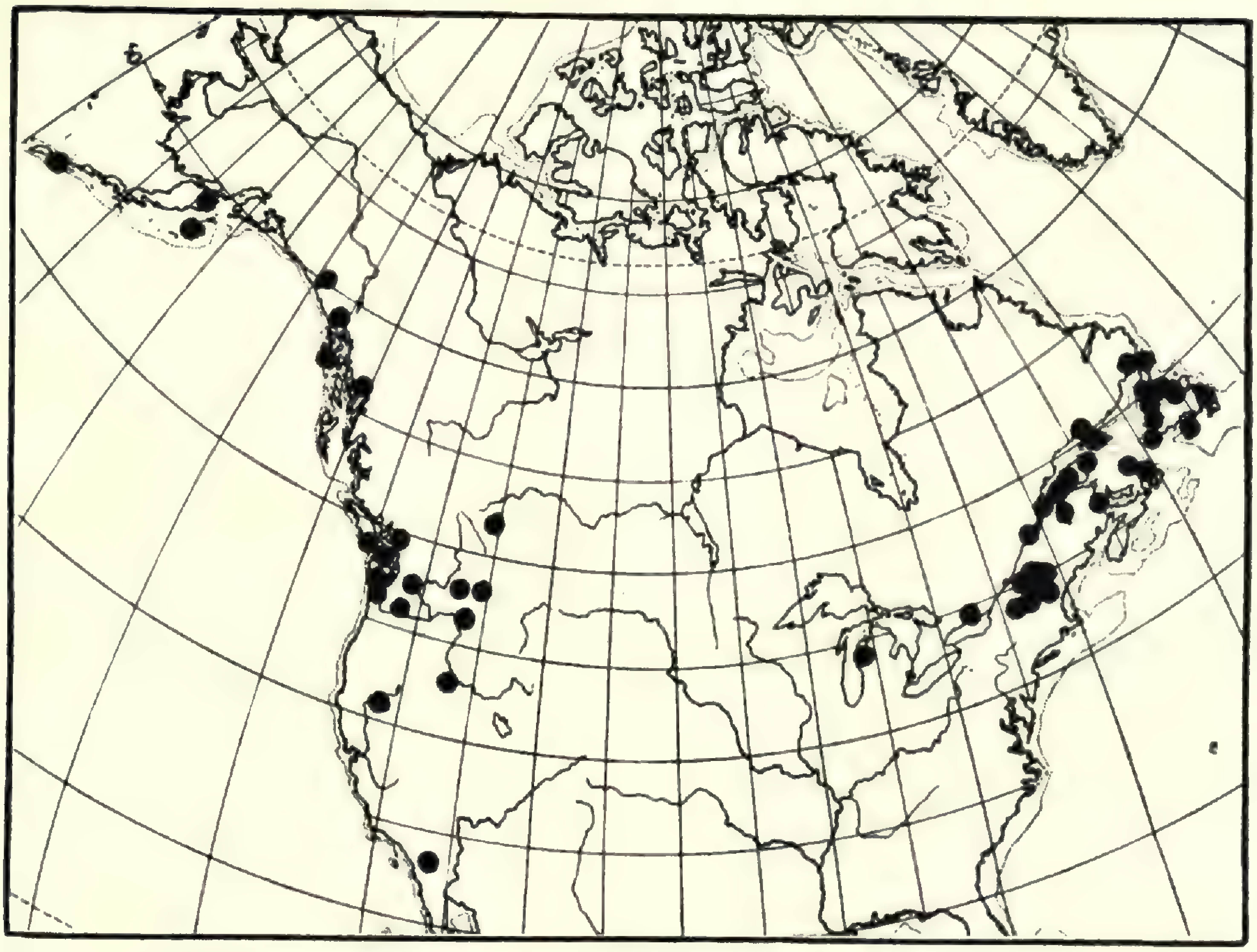
When compared with typical specimens of the two related wide-ranging species of the continent, *G. macrophyllum* and *G. strictum*, the close resemblance in essential characters between *G. perincisum* and *G. macrophyllum* is very marked. The receptacles of the fruiting heads, covered with very short hairs and having a distinctive arrangement of the pits, are scarcely distinguishable in the last two categories, while in *G. strictum* the receptacle is so covered with longer hairs as to obscure the pits. The lower internodes of the styles in the young and mature fruits of both *perincisum* and *macrophyllum* are supplied with minute stalked glands which are entirely absent in *G. strictum*. The general form of the basal leaves in *perincisum* strongly resembles that in *macrophyllum* in having a prominent terminal leaflet of rounded outline, and reduced lateral leaflets. It should be noted further that the major differences by which the two are separated are rather variable in themselves, and are in characters which are notable for their instability in this genus.[2] The deeper lobing in the terminal leaflet of the basal leaves, the reduction of the upper stem leaves, the glandularity of the peduncles, and a tendency toward lack of hairs on the faces of the achenes are the characters in *G. perincisum* which distinguish it from *G. macrophyllum*.

The geographic ranges of the two forms are also significant. Material in the Gray Herbarium and in the Herbarium of the New England Botanical Club has been used to supplement the writer's own and that obtained from the New York Botanical Garden to form the accompanying maps (Figs. 1 and 2).[3] *G. macrophyllum*, originally

[1] Rydberg, P. A. *North American Flora* xxii. 405 (1913).

[2] Fernald, M. L. and Weatherby, C. A. *Varieties of Geum canadense*, Rhodora xxiv. 47 (1922).

[3] Base map by J. Paul Goode, published by the Univ. of Chicago Press.



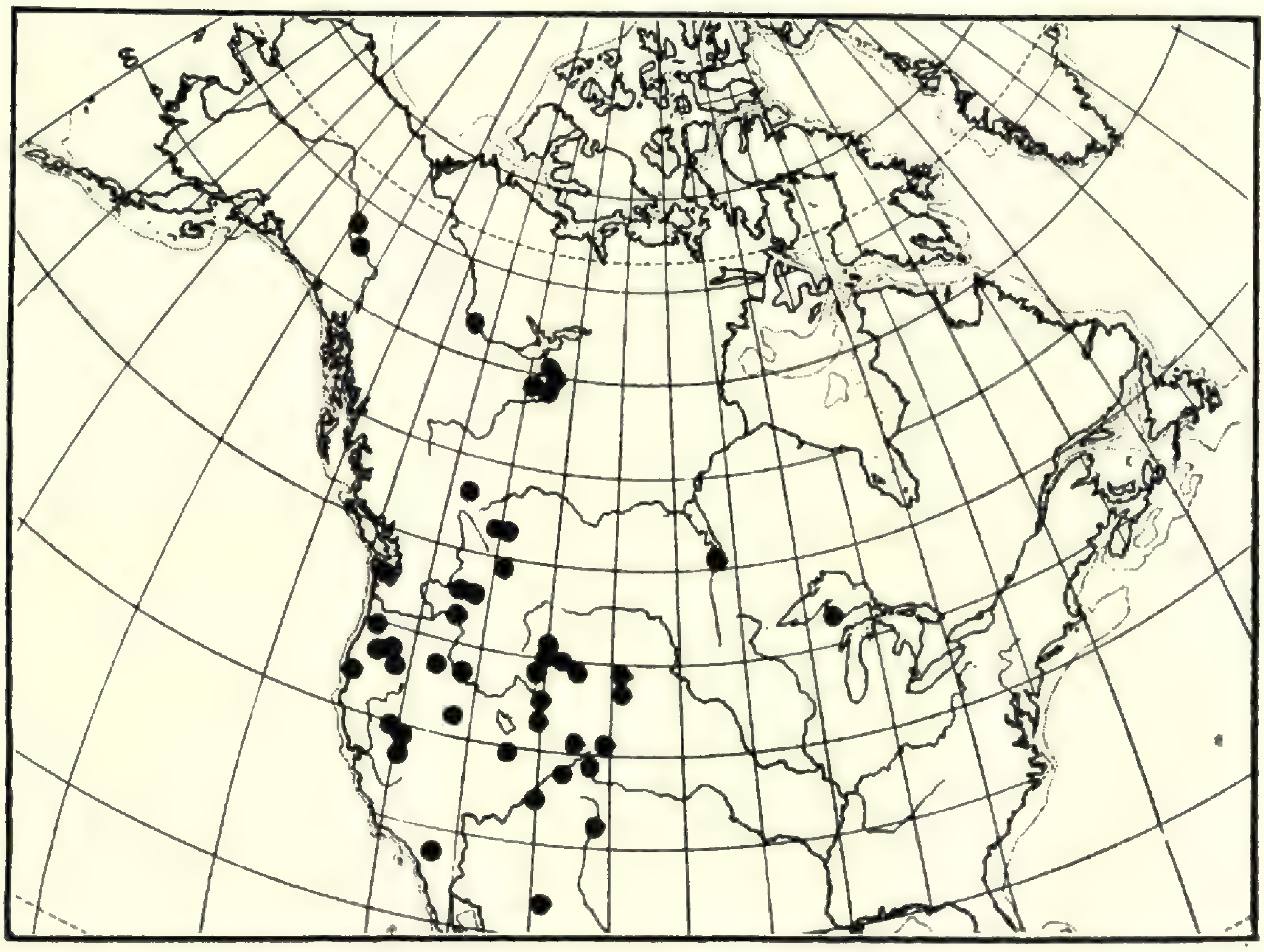


Fig. 1 (upper), Range of Geum macrophyllum. Fig. 2 (lower), Range of G. macrophyllum, var. perincisum.

described by Willdenow from material secured in Kamtchatka, has been found subsequently to be consistent throughout the Canadian forest region of eastern and northwestern North America. It is of interest, however, to find that *G. perincisum* replaces it in the northern and western interior. In view of the fundamental similarity of the latter plant to *G. macrophyllum*, and its geographic relationship, it is proposed that it be considered a geographic variety:

Geum macrophyllum Willd., var. **perincisum** (Rydb.), n. comb. *G. perincisum* Rydb. N. Am. Fl. xxii. 405 (1913).

In the Athabasca-Great Slave Lake region the var. *perincisum* is by far the commonest *Geum*. It extends throughout the subarctic Canadian forest district. *G. strictum*, on the other hand, is limited to the semi-open prairie districts and to cabin and settlement clearings, the two places where the more southern elements are to be found in this flora. *G. triflorum* grows on the driest of the semi-open prairies and has a range similar to that of *G. strictum*.

Gray Herbarium,
Harvard University.

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Frederic Rust Lab

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THE FRENCH APOTHECARY'S PLANTS IN BURSER'S HERBARIUM

H. O. JUEL

CASPAR BAUHINUS in his *Prodromus Theatri botanici*, printed in 1620, describes several plants which had been communicated to him by JOACHIM BURSERUS who had received them from an unnamed apothecary in Paris, with the statement that they were collected in the country named Toupinambault in Brazil. Specimens of these plants, in addition to a few others from the same source, are inserted in BURSERUS' large herbarium or "Hortus siccus" preserved in the Botanical Museum in Upsala.[1] On BURSER'S labels the same statement is given about their origin, only with the exception of one plant (*Trillium*) which is said to be from "Gallia nova," that is, the colony "Nouvelle France" which the French had founded on the St. Lawrence River about the year 1608. But as all these plants belong to North American species, we may assume that all of them were collected in Canada. LINNAEUS, who made extensive studies in Burser's herbarium and mentioned several of these specimens in his dissertation "*Plantae Martino-Burserianae,*" came to the same conclusion about their origin, as can be seen from a passage in his *Species plantarum,* ed. I, p. 305.

Here follows an enumeration of the North American plants in Burser's Hortus siccus. After the number given in that collection comes a copy of Burser's label inclosed in quotation marks. References to the works of BAUHINUS and LINNAEUS and to the "*Studien*

[1] Further information about this famous herbarium is to be found in a memoir entitled "*Studien in Burser's Hortus Siccus*" (Nova Acta R. Soc. Scient. Upsal., Ser. IV, Vol. 5, 1923).

in Burser's Hortus Siccus" are put in parentheses. The modern name is printed in italics.

IV. 29. "Campanula serpillifolia Bauh. Figura est in Prodromo. Accepi Parisiis a Pharmacopaeo, ex Toupinambault allatam." (Bauh. Prodr., p. 35; Linn. H. Cliff., p. 321; Stud., p. 44.) *Linnaea borealis* L.

VII (2) 57. "Videtur eadem cum praecedenti. Ex Toupinambault attulit Pharmacopoeus Parisiensis." *Osmorrhiza* spec., probably *O. Claytoni* (Michx.) Clarke.

VIII. 8. "Affinis praecedenti. Ex Toupinambault sive Brasilia attulit Pharmacopoeus Parisiensis." (Linn. Pl. Mart.-Burs., n. 81; Stud., p. 57.) *Aralia nudicaulis* L.

IX. 12. "Solanum triphyllon Brasilianum Bauh. Ex Gallia nova Lutetiam attulit Pharmacopoeus quidam." (Bauh. Prodr., p. 91; Linn. Pl. Mart.-Burs. nr. 95, footnote; Sp. pl., p. 340; Stud., p. 62.) *Trillium grandiflorum* Salisb.

IX. 138. "Ranunculus Brasilianus. An Ranunculus montanus Aconiti folio albus flore majore Bauh? Ex Toupinambault attulit Lutetiam Pharmacopoeus." (Linn. Pl. Mart.-Burs., p. 155; Stud., p. 65.) *Anemone dichotoma* L., TYPE SPECIMEN.

X. 11. "Cum praecedente convenit. Ex Brasilia per pharmacopoeum Lutetianum." *Actaea*, probably *rubra* (Ait.) Willd.

X. 47. "Vix differt a praecedente. Pharmacopoeus Parisiensis ex Brasilia attulit." *Cypripedium parviflorum* Salisb.

X. 100. "Pyrola Brasiliana foliis cordatis Asari. Ex Brasilia des Toupinambaux attulit pharmacopoeus Lutetianus." (Linn. Pl. Mart.-Burs., p. 156; Stud., p. 67.) *Pyrola asarifolia* Michx.

X. 102. "Pyrola rotundifolia Brasiliana minor. Ex Brasilia per pharmacopoeum Parisiensem accepi." *Pyrola secunda* L.

X. 103. "Pyrola Brasiliana minor, folio magis acuminato. Cum praecedente simul accepi. Forte non differt ab ea quae subseq [uitur]." *Pyrola secunda* L.

X. 106. "Pyrola Alsines flore Brasiliana major Bauh. Des Toupinambaux per pharmacopoeum Parisinum Parisiis ad Bauhinum transtuli." (Bauh. Prodr., p. 100; Linn. Pl. Mart.-Burs., p. 156; Sp. pl. ed. I, p. 118; Stud., p. 68.) *Cornus canadensis* L., TYPE SPECIMEN.

X. 107. "Pyrola Alsines flore Brasiliana minor Bauh. Ex eodem cum priore loco, unde et Bauhino attuli." (Bauh. Prodr., p. 101; Linn. Pl. Mart.-Burs., p. 157; Stud., p. 68.) *Trientalis americana* Pursh.

X. 137. "Dracunculus sive Serpentaria triphylla Brasiliana Bauh. Apud Toupinambaultios legit pharmacopoeus Parisiensis, mihique co[mmun]icavit, unde postea Bauhino exemplar dedi." (Bauh. Prodr., p. 101; Linn. Sp. pl. ed. I, p. 965; Stud., p. 69.) *Arisaema triphyllum* (L.) Schott.

XI. 8. "Viola tricolor erecta latifolia Brasiliana. Apud Toupinambaultios legit pharmacopoeus, Lutetiamque attulit." (Linn. Pl.

Mart.-Burs., p. 157; Sp. pl. ed. I, p. 936; Stud., p. 70.) *Viola canadensis* L., TYPE SPECIMEN.

XI. 98. "Caryophyllus praecedenti similis Brasiliana. Apud Toupinambaultios legit Pharmacopoeus q[ui]dam Lutetianus, mihique co[mmun]icavit." *Sisyrinchium angustifolium* Mill.

XIII. 82. "Melampyrum Brasilianum cyanifolium. Liceat interim sic appellare hanc, a pharmacopoeo mihi datam Lutetiae, quam apud Toupinambaultios legerat." (Linn. Pl. Mart.-Burs., p. 160; Stud., p. 82.) *Castilleja coccinea* (L.) Spreng.

XIV (1) 4. "Lysimachia lutea corniculata Bauh. Lysimachia Virginiana. In Hortis Misniae, Seelandiae. Praesens exemplar attulit Pharmacopoeus Parisiensis ex Brasilia." An *Oenothera*. The flowers are destroyed by insects.

XV (1) 7. "Gnaphalium latifolium Americanum Bauh. Basileae in horto Bauh. Attulit quoque pharmacopoeus Parisiensis ex Brasilia." *Anaphalis margaritacea* (L.) Bth. & Hook.

XVII. 61. "Polygonatum latifolium perfoliatum Brasilianum Bauh. Per pharmacopoeum quendam Lutetiae accepi ex Brasilia." (Bauh. Prodr., p. 136; Linn. Sp. pl. ed. I, p. 305; Stud., p. 99.) *Uvularia grandiflora* Sm.

XVII. 62. "Polygonatum latifolium Brassilianum flore racemoso muscoso. Ex eodem cum praecedente loco." *Smilacina racemosa* (L.) Desf.

XVII. 76. "Hederacea quaedam planta ex Brassilia. Apud Toupinambaultios legit pharmacopoeus Parisiensis." *Tiarella cordifolia* L.

XVII. 77. "Cum praecedente quandam similitudinem gerit. Ex eodem loco." *Mitella diphylla* L.

XVIII (1) 78. "Caryophyllata aquatica nutante flore Bauh. In Misnia, Bohemia, Helvetia, Dania. Accepi quoque ex Brasilia." *Geum rivale* L. This specimen, then, may not be American.

XIX. 41. "Thalictrum maius Brassilianum. Videtur idem cum vulgari. Ex Brassilia attulit Pharmacopoeus Lutetianus." *Thalictrum dioicum* L.

XX. 13. "Adiantum fruticosum Brasilianum Bauh. Ex Brasilia accepi per pharmacopoeum quendam Parisiis." (Bauh. Prodr., p. 150; Stud., p. 108.) *Adiantum pedatum* L.

XXII. 77. "Rhus angustifolium Bauh. Pharmacopoeus Parisiensis ex Brassilia attulit. Puto nil aliud esse quam Sorbum." (Bauh. Prodr., p. 158; Linn. Sp. pl. ed. I, p. 265; Stud., p. 112.) *Rhus glabra* L.

XXII. 79. "Rhus Myrtifolia a suo vicino vix differens. Apud Toupinambaultiosl egit Pharmacopoeus q[ui]dam Parisinus mihique co[mmun]icavit." *Myrica gale* L. Another specimen of this species is glued on the same sheet.

DJURSHOLM, SWEEDEN.

POTENTILLA CANADENSIS AND P. SIMPLEX

M. L. Fernald

(Plates 214 and 215)

During a recent correspondence with Professor H. O. Juel, regarding Kalm's American plants preserved at Upsala, Professor Juel referred to *Potentilla pumila* Poir. as identical with *P. canadensis* L. When this identification of the two first came to my attention I at once wrote Professor Juel that Rydberg (in his *Monograph of the North American Potentilleae*[1] and in his elaboration in the North American Flora[2]) and, consequently, other American botanists, who have automatically followed Rydberg, are treating *P. canadensis* and *P. pumila* as wholly different species. It soon became clear, however, that, although Michaux, Nestler, Hooker and some American botanists of the first half of the last century and some in the first years of the present century had properly identified the species, American botanists in recent years have wholly misinterpreted both *P. canadensis* L. and *P. simplex* Michx., as well as *P. caroliniana* Poir. and, to some extent, *P. sarmentosa* Muhl.

In his article, *A Revision of Kalm's Herbarium in Upsala*,[3] a paper which should be carefully studied by American taxonomists, Professor Juel, in 1921, really settled the identity of *Potentilla canadensis:*

> *Potentilla canadensis* L. A specimen, so determined by Kalm. It belongs to the species which in modern American floras is called *P. pumila* Poir.
>
> The description of P. canadensis given by Linn. from Kalm's specimens contains these words: "habitus Fragariae," "caulis digitalis," and "similis P. vernae." These characteristics suit the plant called P. pumila Poir. far better than the P. canadensis of the American floras, for the latter is a much taller plant with little resemblance to P. verna L. I therefore think that P. pumila Poir. is what Linn. meant by his P. canadensis, and that it ought accordingly to be called by the latter name. The "P. canadensis" of modern authors should then be re-named.

In a letter of November 23, 1930, Professor Juel wrote: "I have seen the specimen in Linné's herbarium in London on which he has written '15 K canadensis.' It was collected by Kalm, as indicated by the letter K. I made this note about it: 'is quite small, even as Kalm's own specimen, evidently—P. pumila Poir.'" I, too, examined the Kalm specimen in the Linnean herbarium about thirty years ago and have a good photograph of it before me. On the basis of this and earlier identifications and identification of the type of *P. simplex* Michx.,

[1] Rydberg, Mem. Dept. Bot. Columbia Univ. ii. 35–37 (1898).

[2] Rydberg in N. Am. Fl. xxii[4]. 302, 303 (1908).

[3] Juel, Svenska Linné-Sällskapets Årsskr. iv. 19, 20 (1921).

New England botanists during the first decade of the present century were correctly using the names *P. canadensis* and *P. simplex*, an understanding reflected in the Flora of Vermont (1900) by Brainerd, Jones & Eggleston. In a foot-note from their record of "**P. simplex**, Michx. (P. Canadensis of American authors in part.)", they said: "Just as this is going to press a letter is received from M. L. Fernald stating that '*Potentilla simplex* Michx. is the common sprawling species of New England, while *P. Canadensis* is a low, hardly repent, canescent species which hardly reaches southern Maine and New Hampshire.' It was not possible to re-examine Vermont specimens other than those in the herbarium of the University of Vermont. All of those proved to be *P. simplex*."[1] In keeping with this understanding of the New England botanists at that period it is significant that of the 28 numbers of *P. canadensis* collected between 1895 and 1905 and represented in the herbarium of the New England Botanical Club 25 were correctly named; but that of the 68 numbers in the same herbarium collected from 1908 to 1918 62 bear the wrong name!

This complete reversal was due to the fact that, in deference to the treatment in Rydberg's *Monograph,* the application of the names was unfortunately reversed in the 7th edition of Gray's Manual. The photograph of the actual Linnean type (PLATE 214, FIG. 1) a small specimen received from Kalm, and the photograph of Kalm's better specimen preserved at Upsala (PLATE 214, FIG. 2), generously supplied by Professor Juel, clearly demonstrate, however, that, as he pointed out ten years ago, *P. canadensis* L. is the plant passing in current American treatments as *P. pumila* Poir. Poiret's *P. pumila* was well described and, like the Linnean species, was compared by its author with *P. verna;* also with *P. acaulis.* I have, as yet, been unable to see a photograph of it, but the description is so clear that there is no reasonable doubt that *P. pumila* Poir. is *P. canadensis* L.

The species which in recent years has erroneously passed in America as *Potentilla canadensis* is a much coarser plant than true *P. canadensis,* with the firm flowering stem erect or strongly ascending, but after anthesis becoming procumbent and sending out many prostrate branches which root at tip. It has three fairly marked extremes: one, called by Rydberg and others "*P. canadensis,*" with "stems . . . generally with spreading pubescence" (*Rydberg,* N. Am. Fl.) or "spreading-hirsute" (*Robinson & Fernald* in Gray, Man. ed. 7) and

[1] Brainerd, Jones & Eggleston, Fl. Vt. 51 (1900).

extending northward only to southern Ontario, southern Quebec and southwestern New Brunswick; a second extreme, more common northward, the plant treated by Rydberg (N. Am. Fl.) as *P. simplex* Michx., by Robinson & Fernald as *P. canadensis*, var. *simplex*. This plant has the "stem . . . erect . . . appressed-pubescent" (*Rydberg*) or "covered *with* shorter *appressed or subappressed hairs or glabrate*" (*Robinson & Fernald*) and it extends north to the Laurentide region of Quebec, northern Maine, Prince Edward Island, Cape Breton and Newfoundland. The third extreme is like the first but with the lower surfaces of the leaves densely silvery-silky, a plant of the interior, from Pennsylvania to Illinois and adjacent regions. As geographic varieties the three are very good, quite parallel with the varieties of *Fragaria vesca* and of *F. virginiana*.

That the tall plant which has recently been passing as *Potentilla canadensis* is not the Linnean *P. canadensis* is now clear, and when the original description of *Potentilla simplex* Michx. is examined it is quickly obvious that Rydberg and, following him, Robinson & Fernald and others, have been misapplying that name also, for Michaux had, not the plant with "appressed-pubescent" or "glabrate" stems, but the extreme which has recently been erroneously called *P. canadensis*. Michaux's diagnosis of his *P. simplex* was unequivocal: "P. erecta, simplex, hirsuta," and his species carefully studied[1] by Nestler, was beautifully illustrated[2] by him. Nestler's illustration (here reproduced as PLATE 215, FIG. 1) of the Michaux type certainly represents the "*P. canadensis*" of recent American authors, and my own decision after examination of the Michaux material was wholly in accord with this interpretation. So far as I can find, the common smoother plant, the only one extending far to the north, which has been erroneously identified as *P. simplex*, has no name; nor can I find a name for the argenteous extreme of the interior.

In the mountains of Virginia and eastern Tennessee and on the Ozark Plateau of southern Missouri there is a plant with cuneate-obovate leaflets, flabelliform or filiform repent stolons and a very conspicuous villosity on petioles, stems, calyx and both leaf-surfaces. This is the plant treated by Rydberg in the North American Flora as

[1] "Parisiis herbaria *Tournefortii*, *Vaillantii*, *Michauxi*, nec non locupletissimum thesaurum Musaei historiae naturalis pervolvi; cujus Administratores mihi insignitur faverunt ut species tam novas quam iconibus nondum illustratas in lucem ederem."—Nestler, Monog. Potent. p. ii (1816).

[2] Nestler, l. c. 25, 40, t. ix. fig. 2 (1816).

Potentilla caroliniana Poir. in Lam. Encyc. v. 595 (1804). Rydberg correctly describes the Tennessee and Missouri plant as having "stems prostrate, . . . usually rooting at the nodes, . . . with spreading pubescence; . . . petioles . . . with coarse usually reflexed hairs; leaflets broadly obovate with a cuneate base, coarsely toothed above, . . . loosely pubescent with long and spreading hairs on both sides; stem-leaves similar but small."[1] Poiret, however, said that *P. caroliniana* had the stems firm and stiff and the leaflets ovate-oblong and serrate-dentate around their margins (not merely above): "*foliolis ovato-oblongis*, . . . facile à reconnaître par ses folioles ovales, oblonges, . . . Ses tiges longues d'un pied, assez fermes, velues, . . . droites . . . folioles . . . divisées en dents de scie assez fortes à leur contour." Poiret's description at once suggests *P. simplex* Michx. and Nestler, when he "turned over (pervolvi)" the specimens at Paris performed an "autopsy" on Poiret's type. The result was that the only synonym of *P. simplex* given by Nestler was "*P. caroliniana Poiret Encycl. 5. p. 595.* (ex autopsia herb. Lamarck)"[2]; and Lehmann in his Monographia (1820) correctly made *P. caroliniana* a synonym of *P. simplex*.

The most extreme specimens of "*P. caroliniana*" Rydb., not Poir., suggest the possibility that they represent a definite specific type, but one of the collections from Tennessee and the material from Virginia, although having the long villosity of the Missouri plant, are otherwise inseparable from typical sericeous *P. canadensis* of the Coastal Plain and Piedmont areas to the east. It is most probable that Rydberg's "*P. caroliniana*" is the primitive type (now found on the Ozark and Appalachian Uplands) from which the more sericeous *P. canadensis* of the Atlantic coastwise area and the eastern Great Lake region was derived.[3] So far as I can ascertain this very villous plant has no name; it must be treated as a geographic variety of the latter species.

Another name which has to be considered is *Potentilla sarmentosa* Muhl. in Willd. Enum. Pl. Hort. Berol. 554 (1809). The description, "folliis . . . obovatis grosse serratis . . . caule procumbente sarmentoso," and Willdenow's statement that it is similar to the prostrate *P. reptans* might apply either to mature *P. canadensis* or

[1] Rydb. N. Am. Fl. xxii.[4] 303 (1908).

[2] Nestler, l. c. 40 (1816).

[3] For consideration of this relationship see Fernald, *Specific Segregations and Identities in some Floras of eastern North America and the Old World*, Rhodora, xxxiii. pp. 38–60 (1931).

to the midsummer and autumnal procumbent state of *P. simplex*. Both interpretations were soon made by students of the group. Nestler (1816) did not know the plant, but simply compiled his description. Lehmann (1820), after examining the original material, placed *P. sarmentosa* in the synonymy of *P. simplex;* but in 1834 Hooker placed it, with reservations, under both *P. canadensis* and *P. simplex*. In the discussion of *P. canadensis* (with *P. pumila* and *P. sarmentosa* as synonyms) Hooker said, "Dr. Boot's specimens of '*P. sarmentosa* of Muhl.,' (and Willd.?), precisely accord with Dr. Torrey's, and with Nestler's description and figure [of *P. canadensis*]. It may be a state of *P. simplex* before the appearance of the runners, but the leaflets are broader and much paler, and silky beneath." [1] Then in the synonymy of *P. simplex*, Hooker gave, besides *P. caroliniana*, "P. sarmentosa. *Willd.* (fide *Lehm.* ex specim. in *Herb. Willd.*) an *Muhl.?*"

The confusion as to the exact identity of *Potentilla sarmentosa* is now, fortunately, cleared, for Professor Diels has most kindly supplied me with very clear photographs of the original material in the Willdenow Herbarium. There are two specimens, each a characteristic runner: sheet no. 2 (our Plate 215, fig. 3) with the most characteristic foliage and the appressed pubescence of *P. canadensis* (*P. pumila*), the other, sheet no. 1 (our Plate 215, fig. 4) with the foliage and stipules and the hirsute petioles of *P. simplex*. In other words, *P. sarmentosa* was based on runners of both *P. canadensis* and *P. simplex* and was a perfect case of a *nomen confusum*. As already noted, the earlier students of our flora and of the genus *Potentilla* had a far more accurate understanding of the species just discussed than their successors have usually shown. Michaux in 1803 clearly differentiated the two species as *P. canadensis* and *P. simplex*. Nestler, in 1816, basing his conclusions on personal examination of the types of Michaux, Poiret and others at Paris, published an authentic plate of *P. simplex* and unequivocally reduced *P. caroliniana* to it. He correctly understood *P. canadensis* and illustrated it, apparently from material collected by Michaux. In 1818, Amos Eaton[2] correctly defined both *P. canadensis* and *P. simplex*, even to noting the slight but fairly constant difference in the petals (in *P. canadensis* "subentire," in *P. simplex* "round-obcordate"), but he treated *P. pumila* as a third species, for

[1] Hook. Fl. Bor.-Am. 1. 192 (1834).
[2] Eaton, Man. ed. 2: 378, 379 (1818).

which *P. canadensis* "may be mistaken." Lehmann, in 1820, correctly understood the two species; in 1824 Jacob Bigelow[1] gave the best characterizations of the two ever published, calling them *P. sarmentosa* (*P. canadensis* being unknown to him) and *P. simplex;* and, as already noted, Hooker correctly understood the two species in 1834.

Torrey & Gray, in 1840,[2] lost sight of the numerous characters (10 contrasting characters enumerated in the synopsis at the end of this paper) and treated the three plants recognized by them as variations of one species and in 1843 Torrey went so far in his failure to understand the plants as to write of *P. canadensis:* "Early in the spring . . . it is the *P. pumila* of Poiret. Later in the season . . . it is the ordinary *P. Canadensis.* Its smoother and more erect state . . . is the *P. simplex* and *P. sarmentosa* of authors."[3] From then on, the two species remained merged as one variable species in the treatments of Gray, Lehmann (Revis. Pot., 1856), Wolf and others; and in 1891 Britton emphasized his merging of them by publishing a special note, saying: "a study of the plant during the past spring in the vicinity of New York has convinced me that *simplex* cannot be separated [from *P. canadensis*] even as a variety, for I found them growing from the same clump. In shaded woodlands the *simplex* condition prevails, while the other prefers open places, and reaches its extreme degree of depression (var. *pumila* T. and G.) in very dry, sterile soil. There is, therefore, no more reason for maintaining varieties in it than in the case of *Erigeron Canadense,* which varies from an inch in height to ten feet or more."[4] More recently, however, everyone who has an intimate field-knowledge of our flora has realized that there are two quite distinct species (Rydberg even treating them as four). If, in reviving the old names in 1898, the original descriptions and their types had been more carefully considered or if Nestler's first-hand identifications of the species of Michaux and of Poiret had been given the weight they deserve, much unnecessary recent confusion could have been avoided.

Since the present paper almost completely realigns the names in the group, it is important to include a brief synopsis of the plants involved and their essential bibliography.

Potentilla canadensis L. Dwarf: rhizome premorse, cylindric, in well-developed plants 0.5–2 cm. long, 4–8 mm. thick: stolons not

[1] Bigelow, Fl. Bost. ed. 2: 204 (1824).
[2] Torr. & Gr. Fl. N. Am. i. 443 (1840).
[3] Torr. Fl. N. Y. i. 208 (1843).
[4] Britton, Bull. Torr. Bot. Cl. xviii. 366 (1891).

bearing tuberous enlargements at their tips: stems at flowering time 0.1–1.5 dm. high, soon becoming prostrate, filiform or flagelliform, 0.3–1 mm. thick: cauline leaves during anthesis not well expanded (those subtending flowers 0.5–3 cm. long, including the petiole, at expansion of the flower); leaflets narrowly cuneate-obovate, coarsely and deeply 5–15-toothed around the rounded summit, entire and cuneate from near the middle; the middle leaflet of the largest leaves (of each plant) 1.5–4 cm. long (—6 cm. in var. *villosissima*): free blades of the basal stipules oblong-lanceolate, flat; stipules (mostly 3-cleft) of mature primary cauline leaves 4–12(–15) mm. long: first flowers usually borne from the node above the first well-developed internode: petals rounded at summit or retuse: first flowers expanded in eastern Massachusetts April 2–June 7.

Two well-marked varieties:

Young growth (stems, petioles, lower leaf-surfaces, calyx, etc.) silky-pilose with appressed or loosely ascending fine pubescence. . Var. *typica*.
Young growth long-villous, the pubescence of stems, petioles, peduncles and calyx loosely spreading to reflexed. . . . . Var. *villosissima*.

Var. **typica**. *P. canadensis* L. Sp. Pl. i. 498 (1753); Michx. Fl. Bor.-Am. i. 303 (1803); Nestler, Monog. Potent. 27, 58, t. x. fig. 1 (1816); Hook. Fl. Bor.-Am. i. 192 (1834). *P. pumila* Poir. in Lam. Encycl. v. 594 (1804); Rydb. in Britt. & Br. Ill. Fl. iii. 515, fig. 1935a (1898), in ed. 2, ii. 251, fig. 2229 (1913), Mem. Dept. Bot. Columbia Univ. ii. 37, t. 18, figs. 1 and 2 (1898), in N. Am. Fl. xxii⁴. 303 (1908); Robinson & Fernald in Gray, Man. ed. 7: 484 (1908). *P. sarmentosa* Muhl. in Willd. Enum. Pl. Hort. Berol. 554 (1809), in part (no. 2 in herb. Willd.); Bigel. Fl. Bost. ed. 2: 204 (1824). *P. canadensis*, β. *pumila* (Poir.) Torr. & Gr. Fl. N. Am. i. 443 (1840); Gray, Man. 122 (1848). *P. canadensis*, β. *sarmentosa* Wood, Class-Bk. 104 (1845). *Callionia canadensis* (L.) Greene and *C. pumila* (Poir.) Greene, Leaflets, i. 238 (1906).—Dry open soil, southern Maine, southern New Hampshire and southern Vermont south to South Carolina, inland across New York to southwestern Ontario and northern Ohio. The following are representative. Maine: Topsham, *Chamberlain*, no. 556; Brunswick, July 25, 1901, May 25, 1912, *Kate Furbish;* Cape Porpoise, May 25, 1895, *Fernald;* North Berwick, May, 1892 and 1893, *Parlin;* South Berwick, June 13 and 14, 1896, *Parlin & Fernald.* New Hampshire: Haverhill, *Fernald.* no. 15,542; Derry, May 10, 1913, *C. F. Batchelder;* Hampton Falls, May 21, 1914, *Batchelder;* Mason, May 15, 1915, *Batchelder;* Merrimack, June 4, 1917, *Batchelder;* Walpole, May 26, 1917, *Bean & Fernald;* Jaffrey, *Robinson*, no. 470; Hinsdale, May 15, 1919, *Batchelder.* Vermont: Putney Mt., Brookline, May 31, 1915, *L. A. Wheeler;* Westminster, *Robinson*, no. 102; Rockingham, May 26, 1917, *Woodward & Wheeler.* Massachusetts: West Manchester, June 7, 1913, *F. T. Hubbard;* Ashby, May 30, 1914, *Knowlton;* Boxborough, *Hubbard & Torrey*, no. 495; Lexington, *Day*

& Fernald in Pl. Exsicc. Gray. no. 100; Milton, May 13, 1900, *Churchhill;* Marshfield, June 6, 1909, *Knowlton;* New Bedford, May 24, 1903, *Hervey;* Barnstable, *Fernald & Long,* no. 16,877; Eastham, *F. S. Collins,* nos. 2011, 2018; Nonamesset, *Fogg,* no. 2677; West Tisbury, *Seymour,* no. 1232; Nantucket, *Day,* no. 20; Leominster, May 30, 1914, *Fernald & Bean;* Southbridge, May 20, 1916, *Churchill & Woodward;* Brookfield, May 16, 1913, *Fernald & Hunnewell;* Greenfield, May 10, 1912, *Batchelder, Kennedy & Williams;* Ware, May 16, 1922, *Knowlton;* Chicopee, May 18, 1913, *Murdock & Torrey;* New Marlboro, July 24, 1912, *R. Hoffmann.* RHODE ISLAND: Providence, May 8, 1904, *E. F. Williams;* Barrington, May 30, 1911, *Fernald;* Warwick, May 2, 1908, *Hope;* Westerly, August 31, 1919, *Weatherby & Collins;* Block Island, *Fernald, Long & Torrey,* no. 9657, *Beattie,* no. 4803. CONNECTICUT: Franklin, July 4, 1912, *Woodward;* Southington, *Andrews,* no. 226; Waterbury, *Blewitt,* no. 691; Salisbury, June 9, 1906, *Fernald;* Fairfield, May 12 and July 31, 1907, *Eames;* Bridgeport, April 25, 1897, *Eames.* NEW YORK: Pelham, May 5, 1886, *D. W. Parker;* Dryden, *Eames & MacDaniels,* no. 4310; Ithaca, *Wiegand & Metcalf,* no. 4309, *Bechtel & Wiegand,* no. 6702; Spencer, *Dean & Eames,* no. 4311. PENNSYLVANIA: West Philadelphia, May 17, 1923, *Meredith.* MARYLAND: Harper's Ferry, April 17, 1890, *S. Watson;* Bladensburg, July 6, 1913, *Steele* (transition to var. *villosissima*). DISTRICT OF COLUMBIA: Takoma Park, May 5, 1899, *T. A. Williams;* Sheridan's Creek, Washington, May 29, 1913, *Steele.* VIRGINIA: Mt. Vernon, *Pease,* no. 7413; Hot Springs, *Hunnewell,* no. 4026. SOUTH CAROLINA: Summerville, *Robinson,* no. 253. ONTARIO: Tillsonburg, *J. Macoun,* no. 34,428. OHIO: Newell Ledge, Portage Co., *R. J. Webb,* no. 5244. Apparently crosses with *P. simplex.*

Forma **ochroleuca** (Weatherby), n. comb. *P. pumila,* forma *ochroleuca* Weatherby, RHODORA, xi. 153 (1909).—Petals cream-colored. Known only from the original station (now obliterated), at Cambridge, Massachusetts.

Var. **villosissima**, n. var., caulibus petiolis pedunculis calicibusque longe villosissimis, villis laxe divergentibus vel reflexis; foliolis maturis 1.5–6 cm. longis.—Virginia, Tennessee and Missouri; doubtless elsewhere.[1] VIRGINIA: between Warrenton and the hills, April 19, 1913, *Tidestrom,* no. 6226. TENNESSEE: top of Cade's Cove Mt., Blount Co., May 20, 1928, *W. A. Anderson, Jr.,* no. 911; three miles north of Coal Creek, Anderson, April 6, 1928, *W. A. Anderson, Jr.,* no. 726. MISSOURI: common on hills, Monteer, May 13, 1901, *Bush,* no. 453 (TYPE in Gray Herb.); common in woods, Monteer, *Bush,* no. 186; Rhyse, Dent County, May 9, 1927, *J. H. Kellogg.* Var. *villosissima* is the *P. caroliniana* Rydb. N. Am. Fl. xxii[4]: 303 (1908), not Poir. in Lam. Encyc. v. 595 (1804).

[1] Introduced, undoubtedly with earth accompanying roots of trees or shrubs from the Ozark area, into the Arnold Arboretum, Jamaica Plain, MASSACHUSETTS (*E. J. Palmer,* no. 28,014).

P. SIMPLEX Michx. Coarser than *P. canadensis:* rhizome irregularly enlarged, often nodose or moniliform-thickened, up to 8 cm. long, 0.5–2 cm. thick: stolons late in the season bearing tuberous enlargements (young rhizomes), especially at the rooting tips: stems at first erect or ascending, up to 2–5 dm. high, then greatly prolonging, arching, forking and rooting at tips, 1–3 mm. thick at base: cauline leaves during anthesis mostly well expamded (those subtending flowers 1.5–10 cm. long, including the petiole, at expansion of the flower); their leaflets narrowly obovate, narrowly elliptical or oblanceolate; the middle leaflets of the largest leaves (of each plant) 1.5–7.5 cm. long, 9–27 toothed for about three-fourths their length: free blades of basal stipules linear-lanceolate, long-attenuate, usually inrolling; stipules (simple or cleft) of mature primary cauline leaves 0.7–3 cm. long: first flower usually from the node above the second well-developed internode: petals obcordate or retuse: first flowers expanded in eastern Massachusetts April 30–June 23.

Three pronounced varieties.

Leaves green and more or less strigose-pubescent or slightly whitened but not copiously silvery-sericeous beneath.
Stems (especially when young) hirsute or villous-hirsute, with spreading hairs. . . . . Var. *typica.*
Stems strigose with short appressed hairs or glabrate. . . Var. *calvescens.*
Leaves densely silvery-sericeous beneath: pubescence of stems spreading, usually dense. . . . . Var. *argyrisma.*

Var. **typica**. *P. simplex* Michx. Fl. Bor.-Am. i. 303 (1803); Nestler, Mon. Pot. 40, t. ix. fig. 2 (1816); Eaton, Man. ed. 2, 379 (1818); Lehm. Mon. Gen. Pot. 142 (1820); Bigel. Fl. Bost. ed. 2: 204 (1824); Hook. Fl. Bor.-Am. i. 192 (1834). *P. caroliniana* Poir. in Lam. Encyc. v. 595 (1804), not Rydb. N. Am. Fl. xxii[4]. 303 (1908). *P. sarmentosa* Muhl. in Willd. Enum. Hort. Berol. 554 (1809), in part (sheet no. 1 in Willdenow Herb.). *P. canadensis,* β. *simplex* (Michx.) T. & G. Fl. N. Am. i. 443 (1840), at least as to name-bringing synonym. *P. canadensis* Rydb. Mem. Dept. Bot. Columb. Univ. ii. 35 (1898), N. Am. Fl. xxii.[4] 303 (1908) and in Britton & Brown, Ill. Fl. ed. 2, ii. 251, fig. 2230 (1913); Robinson & Fernald in Gray, Man. ed. 7: 484 (1908); not L. Sp. Pl. i. 498 (1753).—Dry to moist open soil of fields, thickets, open woods, etc., central Nova Scotia and southwestern New Brunswick to southern Quebec, southern Ontario and Minnesota, south to North Carolina, Tennessee, southern Missouri and Oklahoma. The following are characteristic. QUEBEC: Deschênes sur la riviére Ottawa, *Rolland,* no. 15,505; Longueuil, *Victorin,* no. 3248. NEW BRUNSWICK: St. Andrew's, June 16, 1900, *J. Fowler;* NOVA SCOTIA: Bridgewater, *Fernald & Long,* no. 23,961 (late-summer state, with lateral leaflets uncleft, distributed as *P. pumila*). MAINE: Isle au Haut, July 12, 1920, *Kidder;* Rockland, *C. A. E. Long,* no. 570; South Poland, 1893, *Kate Furbish;* Cape Porpoise, May 25, 1895, *Fernald,* NEW HAMPSHIRE: Stratford Hollow, *Pease,* no. 13,574;

Fig. 1 (upper). Type of Potentilla canadensis in Linnean Herbarium.
Fig. 2 (lower). Specimen in Kalm's Herbarium in Upsala (photograph from Professor H. O. Juel.)

H. M. Gilkey del.

Fig. 1. Type of Potentilla simplex, × ¾, after *Nestler*. Fig. 2. Rhizome of P. simplex, × ¾. Fig. 3. P. sarmentosa, × ⅖ (sheet no. 2 in Herb. Willdenow). Fig. 4. P. sarmentosa, × ⅖, (sheet no. 1 in Herb. Willdenow).

Lebanon, June 3, 1887, *Kennedy;* Woodstock, *Fernald,* no. 11,728; Hampton Falls, June 4, 1916, *C. F. Batchelder;* Walpole, June 12, 1912, *Batchelder;* Hinsdale, June 9, 1920, *Batchelder.* VERMONT: North Haven, May 25, 1879, *Brainerd;* Middlebury, June 4, 1908, *Kennedy;* Hartford, June 12, 1920, *Eaton & St. John;* Rutland, *Eggleston,* nos. 1195–1197; Westminster, *Robinson,* nos. 101, 102. MASSACHUSETTS: Andover, *Pease,* no. 3649; Sudbury, May 24, 1918, *Knowlton;* Middlesex Fells, June 9, 1920, *Kidder;* Boxborough, *Hubbard & Torrey,* no. 463; Wellesley, May 31, 1899, *Rich;* Westwood, May 30, 1899, *Kennedy;* West Stoughton, May 22, 1909, *Blake;* Fall River, May 27, 1910, *Sanford;* Sandwich, *Fernald & Long,* no. 18,563; Eastham, *F. S. Collins,* no. 2094; Worcester, *Wiegand,* no. 1083; Erving, May 14, 1915, *Hunnewell, Macbride & Torrey;* South Hadley, June 10, 1926, *Knowlton;* Granby, May 29, 1910, *Knowlton;* Chicopee, *Murdoch & Torrey,* no. T439; Russell, *St. John & White,* no. 124; Adams, May 15, 1915, *Knowlton & Bean;* Sheffield, May 30, 1919, *Bean & Fernald.* RHODE ISLAND: Cumberland, May 29, 1904, *Williams;* Providence, *Chamberlain,* no. 80; Foster, June 10, 1922, *Eaton & Fassett;* Johnson, May 30, 1911, *Collins;* Block Island, *Fernald, Long & Torrey,* nos. 9600, 9656, 9658 (distributed as *P. pumila*). CONNECTICUT: Thompson, June 10, 1922, *Bill & Grigg;* Hebron, *Weatherby,* no. 4094; Meriden, May 17, 1903, *L. Andrews;* Huntington, June 5, 1902, *Eames;* Stratford, June 9, 1901, *Williams.* NEW YORK: Lisbon, *Phelps,* no. 1403; Brooklyn, June 2, 1885, *L. M. Parker;* Canadice, *C. C. Thomas,* no. 4312. NEW JERSEY: Stelton, *Halsted,* no. 128. PENNSYLVANIA: Sellersville, April 30, 1921, *Fretz.* DELAWARE: Newark, May 11, 1922, *Meredith.* VIRGINIA: White Rock Mt., June 21, 1892, *Small;* Covington, *Hunnewell,* no. 4032; Buckroe, *Robinson,* no. 474. ONTARIO: Belleville, May 24, 1878, *J. Macoun;* Leamington, *J. Macoun,* no. 34,409; Amherstburg, June 10, 1882, *Macoun.* OHIO: Newell Ledge, Portage Co., *R. J. Webb,* no. 5253; Oberlin, May, 1890, *Kofoid;* Sugar Grove, May 20, 1905, *Gleason.* KENTUCKY: Rice Station, Estill Co., *W. A. Anderson, Jr.,* no. 467. TENNESSEE: Elkmont, *W. A. Anderson, Jr.,* no. 843; Oliver Springs, *Anderson,* no. 955; Hollow Rock Jct., *Svenson,* no. 381; Memphis, *E. J. Palmer,* no. 17,276. MICHIGAN: Turin, June 20, 1901, *Barlow;* Douglas Lake Region, *Ehlers,* no. 361; Grand Rapids, 1900, *E. J. Cole.* ILLINOIS: Peoria, June, 1903 and 1904, *McDonald;* Muncie, May 24, 1908, *Gleason;* Decatur, *Gleason,* no. 217; Starved Rock, *Greenman, Lansing & Dixon,* no. 52. MINNESOTA: St. Paul, *Beach,* no. 102. IOWA: Fayette, June, 1894, *Fink.* MISSOURI: St. Louis Co., May 16, 1877, *Eggert;* Cedar Gap, *Lansing,* no. 2973. KANSAS: Cherokee Co., *Hitchcock,* no. 675. OKLAHOMA: Page, *Stevens,* no. 1478.

Var. **calvescens**, n. var., caulibus petiolisque strigosis vel glabratis; foliis subtus strigosis vel glabratis.—Newfoundland, Cape Breton and Prince Edward Island to the Laurentide district of Quebec, and west to Minnesota, south to South Carolina, Illinois and Oklahoma. The

following, from among the numerous specimens (especially from the North) are characteristic. NEWFOUNDLAND: Rushy Pond, *Fernald, Wiegand, Bartram & Darlington,* no. 5782. QUEBEC: Valcartier, *Victorin,* no. 20,925. PRINCE EDWARD ISLAND: Mt. Stuart, *Fernald, Bartram, Long & St. John,* no. 7634; Morell, *Fernald & St. John,* no. 11,095. NOVA SCOTIA: Atlantic Cove, St. Paul Island, *Perry & Roscoe,* no. 247; Baddeck Bay, Cape Breton, *J. Macoun,* no. 19,092; Middleton, *Fernald, Pease & Long,* no. 21,506; Bridgewater, *Fernald & Long,* nos. 23,962, 23,963 (distributed as *P. pumila*); Boylston, July, 1890, *C. A. Hamilton;* Meteghan, *Fernald & Long,* no. 21,507; Yarmouth, *Howe & Lang,* no. 110, *Bissell & Long,* no. 21,505; Atwood Brook, *Bissell & Long,* no. 23,964. NEW BRUNSWICK: Shediac Cape, July 6, 1914, *F. T. Hubbard.* MAINE: Fort Fairfield, August 15, 1901, *Robinson;* Ashland, *Fernald,* no. 2301; Veazie, August 22, 1908, *Fernald;* Dover, June 29, 1896, *G. B. Fernald,* no. 156; Pembroke, July 27, 1909, *Fernald,* no. 1917 (TYPE in Gray Herb.); Roque Bluffs, July, 1913, *Knowlton;* Seal Harbor, July 23, 1889, *Redfield;* Northeast Harbor, August 5, 1910, *Williams;* Deer Isle, *A. F. Hill,* no. 2083; Dedham, *Fernald & Long,* no. 13,826; Matinicus, *C. A. E. Long,* no. 67; Bristol, July 9, 1903, *Churchill;* Leeds, July 23, 1915, *Knowlton;* Cumberland, July 5, 1900, *Chamberlain.* NEW HAMPSHIRE: Pittsburg, *Pease,* no. 10,134; Randolph, *Pease,* nos. 10,012, 12,766; Shelburne, *Fernald & Pease,* no. 16,975 (as *P. pumila*); Woodstock, *Fernald,* no. 11,729; Hillsborough, July 28, 1920, *C. F. Batchelder;* Jaffrey, *Robinson,* no. 118; Alstead, *Fernald,* no. 547. VERMONT: Clarendon, *Eggleston,* no. 1194; Townshend, June 24, 1916, *L. A. Wheeler;* Manchester, *Day,* no. 62. MASSACHUSETTS: Gloucester, June 7, 1896, *Rand & Robinson;* Beaver Brook Reservation, June 13, 1921, *Kidder;* Boston, September 15, 1901, *Rich;* Dover, *Hunnewell,* no. 2751; New Bedford, May 29, 1903, *Hervey;* Falmouth, *Fernald,* no. 602; Barnstable, *Fernald & Long,* nos. 16,876, 18,564; Nonamesset, *Fogg,* no. 3355; Cuttyhunk, *Fogg,* no. 2536; Polpis, *Day,* no. 55; Lancaster, May 30, 1914, *Hunnewell & St. John;* Holden, May 30, 1912, *Blake & Fernald;* Worthington, *Robinson,* no. 686; Middlefield, *Fernald & Long,* no. 9659; Montville, June 28, 1912, *Hoffmann.* RHODE ISLAND: Providence, July 4, 1892, *Collins;* Barrington, May 30, 1911, *Fernald;* Newport, June 19, 1903, *Robinson;* South Kingston, June 11, 1927, *Bill, Eaton & Rehder.* CONNECTICUT: Thompson, *Weatherby,* no. 4863; Stafford, *Weatherby,* no. 2653; Glastonbury, June 2, 1912, *Driggs.* NEW YORK: Boreas Ponds, Essex Co., *House,* no. 9093, in part; Canton, *Phelps,* no. 1607; Fisher's Island, *St. John,* no. 2742; Caroline, *Eames & Wiegand,* no. 12,224; Dryden, *Eames & Gershoy,* no. 10,121; Dryden, *Gershoy,* no. 8317. PENNSYLVANIA: south of Moscow, *L. F. & F. R. Randolph,* nos. 19, 50. MARYLAND: Washington, *Hunnewell,* no. 6614. DISTRICT OF COLUMBIA: Naucks, June 1, 1913, *Steele.* SOUTH CAROLINA: Summerville, *Robinson,* no. 252 (transition to var. *typica*). ILLINOIS: Champaign, *Pease,* no. 11,850. WISCONSIN:

Trempleau Valley, July 20, 1892, *Schuette* (distributed as *Rubus triflorus*). MINNESOTA: Nichols, June, 1892, *Sheldon*. OKLAHOMA: Idabel, *H. W. Houghton*, no. 3652; Pawhuska, *Stevens*, no. 2038.

Var. *calvescens*, well marked in the North and the only form of the species in most of the area from central Maine to Newfoundland, is usually not so well marked southward. Northward it often occurs in wet thickets or meadows and even in wet sphagnous bogs. It is the plant mistakenly identified in recent years as typical *P. simplex*: *P. canadensis*, var. *simplex* Rydb., Mem. Dept. Bot. Columbia Univ. ii. 36 (1898); Robinson & Fernald in Gray, Man. ed. 7: 484 (1908); not Torr. & Gray (1840), at least as to type. *P. simplex* Rydberg, N. Am. Fl. xxii[4]. 302 (1908) and in Britton & Brown, Ill. Fl. ed. 2, ii. 251, fig. 2228 (1913); not Michx. Fl. Bor.-Am. i. 303 (1803).

Var. **argyrisma**, n. var., foliis subtus dense argenteo-sericeis; caulibus villosis vel villoso-hirsutis.—Pennsylvania to Kentucky and Illinois. PENNSYLVANIA: between York Furnace and Tucquan, May 11, 1901, *Heller*. KENTUCKY: Robard, Henderson Co., *W. A. Anderson, Jr.*, no. 24. ILLINOIS: roadside, Urbana, May 13, 1910, *Pease*, no. 12,547 (TYPE in Gray Herb.); Decatur, May 11, 1915, *Clokey;* Bird Haven, Olney, *Ridgeway*, nos. 718–720.

EXPLANATION OF PLATES 214 AND 215.

PLATE 214. POTENTILLA CANADENSIS L. FIG. 1 (upper). The Kalm specimen in the Linnean herbarium (TYPE of the species). FIG. 2. The Kalm specimen preserved in Upsala (photograph from PROFESSOR H. O. JUEL).

PLATE 215. FIG. 1. TYPE of POTENTILLA SIMPLEX Michx., after *Nestler*, × ¾. FIG. 2. Rhizome of P. SIMPLEX, × ¾. FIG. 3. Sheet no. 2 of P. SARMENTOSA Muhl. in Herb. Willdenow (from photograph supplied by PROFESSOR L. DIELS), × ⅖. FIG. 4. Sheet no. 1 of P. SARMENTOSA Muhl. in Herb. Willdenow (from photograph supplied by PROFESSOR L. DIELS), × ⅖. Plate drawn by DR. H. M. GILKEY.

THE PENNSYLVANIA STATIONS OF ARCEUTHOBIUM PUSILLUM.—Ludlow Griscom's article in the April number of RHODORA, recording the interesting discovery by himself and Mr. K. K. Mackenzie of *Arceuthobium pusillum* at Pine Swamp in Sussex Co., New Jersey, states that its "range is here extended south from northwestern Connecticut."

The statement would seem to imply that the dwarf mistletoe had not previously been found so far south. It has long been known, however, from a number of places in northeastern Pennsylvania and particularly from the bog near Tannersville in Monroe Co.—locally called "The Cranberry"—some thirty miles southwest of Messrs. Griscom and Mackenzie's Sussex Co. swamp and about 250 ft. lower

in altitude. If a line be drawn from Kent, Connecticut[1] southwest to Tannersville, Pa., Pine Swamp will be found to lie a little to the north of it, and the occurrence of the parasite there is of interest as adding a station along its southern range rather than as extending the range southward, and also as adding one on the eastern side of the Delaware Valley to those already known in the same region on the western.

The material in the herbarium of the Academy of Natural Sciences shows a somewhat wider distribution of the species in Pennsylvania than is assigned to it in the local Floras. Porter's "Flora of Pennsylvania" records it only from Monroe and Pike Counties,—or rather inadvertently appears to do so. But Lehigh Pond, one of the two stations given for Monroe, is in Wayne Co. Taylor's "Flora of the Vicinity of New York" gives its Pennsylvania range as "Mountain summits in Pike and Monroe Counties," and Twining's "Flora of Northeastern Pennsylvania" notes only Tannersville and Lehigh Pond. It may, therefore, not be without interest to add a list of the collections at hand. They are:

Monroe County
    Tannersville, Sept. 10, 1896, *Walter Seibert;* and a series of others collected there at subsequent dates by various botanists.
Pike County
    Spruce Pond, July 9–16, 1899, *Stewardson Brown.*
    Mud Pond, July 9–16, 1899, *Brown & Saunders.*
Wayne County
    Marsh above Lehigh Pond, 1886, *Dudley.*
Sullivan County
    Shadynook, July 16, 1901, *Stewardson Brown.*
    Near Lopez, August 25, 1908, *C. S. Williamson.*

Dr. Witmer Stone tells me that Shadynook—a name not to be found on most maps—is about 2½ miles from Lopez, and the two Sullivan Co. collections may quite probably come from the same place.—ARTHUR N. LEEDS, The Academy of Natural Sciences, Philadelphia.

RORIPPA AMPHIBIA IN FAIRFIELD COUNTY, CONNECTICUT.—On June 8, 1930, while driving along the Danbury Road in the Town of Ridgefield, the writer's attention was attracted by a colony of plants of the mustard family which had an unfamiliar look. Failing to

[1] The southernmost point of its distribution in Connecticut according to Eaton's map in the issue of RHODORA quoted above.

identify the plant, a specimen was sent to Mr. C. A. Weatherby, who very kindly reports as follows: "*Rorippa amphibia* (L.) Bess.—Except for one old record, now proved erroneous, the only American locality for this species is on the St. Lawrence River, near Montreal, where it grows luxuriantly in shallow water (Brother Marie-Victorin)."

At the Ridgefield station for this plant none of the plants were growing in water. Some in fact were on very dry soil, though near a ditch. Two possible means of introduction suggest themselves. A railroad runs within a hundred yards of the colony while on the opposite side is a newly established nursery.—LEONARD J. BRADLEY, Wilton, Conn.

PEDICULARIS LABRADORICA.—It seems to have been generally overlooked that the boreal species, which is regularly passing as *Pedicularis euphrasioides* Stephan in Willd. Sp. Pl. iii[1]. 204 (1801), has an earlier and valid name which should be revived. The species was published and clearly illustrated in Houttuyn, Pflanzensyst. viii. 39, t. 57C (1782). When he took up Stephan's manuscript-name, Willdenow knew of *P. labradorica,* which he treated as an American variety of the Asiatic species of Stephan, as "β. P. (*labradorica*)". I have not seen the Stephan material, but the Siberian plant is usually considered identical with the American. The latter, at least, should be called P. LABRADORICA Houttuyn (1782) rather than *P. euphrasioides* Stephan (1801).—M. L. FERNALD.

NOTES ON VACCINIACEAE

W. W. ASHE

VACCINIUM § CYANOCOCCUS Gray

VACCINIUM **missouriense**, sp. nov. Frutex 2–5 dm., *Vaccinio V. Margarettae* dicto potius quam *V. vacillanti,* baccis nigris nitidis et racemis pubescentibus similis, differt tamen foliis crassis, subdistichis, oblongis, lanceolatis vel oblanceolatis, basi acutis. Ramuli griseo-pubescentes. Folia decidua, crassa, lanceolata, oblanceolata vel oblonga, 3.5–5 cm. longa, 1.5–2 cm. lata, acuta, basi cuneata, integra, supra minute pubescentia, subtus griseo-pubescentia, subdisticha. Racemi breves conferti, pedunculis et saepe pedicellis pubescentibus. Baccae nigrae, nitidae, nunquam glaucae, parvae, 5–7 mm. diametro. Flores non visi.—Prope Monteer, MISSOURI. *V. vacillans* var. *Missouriense* Ashe in Torreya **25**: 10. 1925.

A straggling shrub 2–5 dm. high with underground stems, twigs green, pubescent with short curved grayish hairs persistent until the

third year. Leaves thick, oblanceolate, lanceolate or oblong, 3.5–5 cm. long, 1.5–2 cm. wide, acute, cuneate at base, entire, yellowish green and sparingly pubescent above, pubescent below with rather long spreading grayish simple hairs. Buds large, bright red, glabrous, outer scales mucronate. Racemes short, compact, 3–6-fruited; peduncles which are rarely 1 cm. long, and usually the 3–5 mm.-long pedicels as well, pubescent, or pedicels merely puberulent, with short spreading grayish hairs. Flowers unknown. Fruit black. TYPE, *W. W. A.* Monteer, Shannon County, MISSOURI, May 9, 1924, and (from the same bush) Sept. 13, 1923.

The dullish black fruit in short pubescent racemes and the prevailingly oblanceolate entire leaves are distinctive in separating this plant from *V. vacillans* which grows with it. Its affinities seem to be rather with *V. Margarettae* Ashe of the Southern Appalachians than with *V. vacillans* but it is well separated from both.

VACCINIUM **serum**, sp. nov. Frutex 1–1.5 m. alta, ramulis plerumque glabris glaucisque. Folia decidua, plerumque oblonga et acuta, subinde elliptica et obtusa, rariter rhombea, 3.5–6 cm. longa, 2–2.7 cm. lata, integerrima, perspicue venosa, glabra vel costis subtus pubescentibus. Racemi 5–11-flori, glabri, pedunculo stricto, pedicellis multum longiore; pedicellis superioribus quam corolla longioribus; pedicellis inferioribus quam corolla brevioribus; floribus tardis. Corrolla subcylindracea, alba, 5–7 mm. longa. Baccae parvae, 6–8 mm. diametro, nigrae sive glauco-nigrae.—In collibus sylvaticis Virginiae et Marilandae prope Washington.

A shrub 4 to 9 dm. high. Twigs slender, green or yellowish, rarely reddish, glabrous and glaucous or sometimes pubescent but not in lines. Leaves prevailingly of an oblong or elliptic type, sometimes rhombic, occasionally oblong-ovate, or the smaller broadly elliptic or even ovate, the larger 3.5 to 6 cm. long, 2 to 2.7 cm. wide, acute at apex, narrowed or acute at base, often sessile or the short petiole margined, entire, often with 2 to 3 pairs of red sessile glands near the base, above glabrous from the first or the midrib permanently puberulent, beneath slightly paler and glabrous or the midrib and a few larger veins sparingly pubescent, bronze or reddish as they unfold, at length dark green above, the prominent veins often reddish beneath. Flowers appearing when the leaves are about half grown in glabrous rather elongated, 2 to 2.5 cm.-long racemes, often clustered at the ends of naked twigs, short cylindric or somewhat campanulate, 5 to 6 mm. long, 3 to 3.5 mm. thick, rarely as much as twice as long as thick, open at the mouth, white or flesh colored; calyx glabrous fully one half the length of the corolla; style barely as long as the corolla; the lower pedicels about the length of the flowers, the upper less than half as long; bracts spatulate, small, reddish, early deciduous. Fruit small, 5 to 8 mm. thick, subglobose or ovate, blue-black, usually with a bloom, capped by the erect and prominent divisions of the calyx.

Common along the Potomac river, in both Maryland and Virginia at Great Falls and extending into the District of Columbia, often on rock bars where it grows with *Amelanchier sera* Ashe and *A. oblongifolia* Roem., or in rocky woods, where many collections have been made since 1916. The TYPE, both flowers and fruit from the same plant, Great Falls, VIRGINIA, near Elkins station; flowers, May 3, 1918; fruit, June 23, 1918. *W. W. A.*

It was at one time supposed that this form might be referred to *V. Marianum* Wats.,[1] since the cultivated plant upon which his description was based probably came from Maryland. His detailed and tabulated description, however, calls for peduncle or floral "axis covered with thick white hairs," "pedicels twice length of flower" and for pistil "length of the stamens." No specimen of the form under consideration has been found which has these characteristics, or any one of them.

V. SERUM var. **pubifolium**, var. nov., a typo differt foliis subtus pubescentibus.

This variety differs from the type form in having the lower surface of the leaves pubescent.—TYPE, *W. W. A.* Great Falls, VIRGINIA, May 4 and June 23, 1918.

VACCINIUM VACILLANS Sol. var. **columbianum**, var. nov., a typo differt foliis majoribus, crassis, subtus plerumque rubro-nervosis.

Leaves glabrous, larger than in the type, thicker, with the veins prominent beneath and usually red. TYPE, *W. W. A.* Below Great Falls, VIRGINIA, April 28 and June 23, 1918. This variety is very common along the Potomac River growing with the type form in Maryland, Virginia and District of Columbia.

V. VACILLANS var. COLUMBIANUM f. **mollifolium**. Folia subtus molliter pubescentia.

The glabrous large-leaved variety passes into a form which occurs with it having the leaves softly pubescent beneath.—TYPE, *W. W. A.* Chesapeake Beach, Calvert County, MARYLAND, July, 1916.

VACCINIUM **arkansanum**, sp. nov. Frutex 1.5–4 m. alta. Folia ovata, 6–8 cm. longa, 2.1–3 cm. lata, apice acuta, integra, subtus pubescentia. Racemi 6–10-flori, glabri, floribus albis, subcylindraceis, quam in *V. atrococco* longioribus, quam in *V. corymboso* brevioribus. Baccae glaucae, 6–10 mm. diametro. In umbrosis humidis prope Hot Springs, Arkansas.

A shrub 1.5–4 m. tall with furrowed but close brown bark. Leaves ovate, 6–8 cm. long, 2.1–3 cm. broad, gradually acute, usually rounded at the rather broad base, entire, dark green above, slightly paler and sparingly pubescent beneath. Racemes 6–10-flowered, glabrous. Corolla white or greenish, short cylindrical, 5–8 mm. long, nearly as wide as long, the mouth open. Berry 6–10 mm. in diameter, blue-

[1] Dend. Brit. 2: *t.* 124. 1825.

black beneath a bloom.—TYPE: *W. W. A.*, flowers and fruit from the same clump, 6 miles north of Hot Springs, ARKANSAS, on the Little Rock road Apl. 15, 1928, June 27, 1929.

This plant which grows with alder in swamps and along small streams in Garland and Perry counties, Ark., has been confused with *V. corymbosum* when in flower and with *V. atrococcum* when in fruit. The fruit is considered to be of only fair eating quality.

VACCINIUM **alto-montanum**, sp. nov. Frutex 3–10 dm. alta, *V. pallido* affinis, ab eo recedit tamen foliis oblongis minoribusque. Folia decidua, oblonga, apice et basi acuta, 2.8–5.3 cm. longa, membranacea, glabra, subtus pallida, integra, ciliata, venulosa. Racemi 6–10-flori, glabri. Baccae glaucae, 8–14 mm. diametro.—Montes alti Carolinae-Septentrionalis et Tennesseensis.

Leaves rather thin, 2.8–5.3 cm. long, 0.9–1.4 cm. wide, oblong, gradually narrowed and acute at each end or narrowed to a slightly rounded base, glabrous on both faces, pale, prominently veined, and more or less reticulated below, almost sessile, the petiole puberulous, entire or finely serrulate or ciliate. Berries (from Cassi Creek, Unicoi Co., Tenn.) 8–14 mm. thick, dark blue with a bloom, finely flavored. Racemes 1.8–2.6 cm. long, 6–12-flowered; calyx lobes broadly triangular or ovate-triangular, prominent. Buds red, glabrous, scales mucronate.

Head of Cassi Creek, Unicoi County, Tennessee, July, 1922. High ridges of Wilson Bald, Unicoi County, Tenn., July, 1922. Rabun County, Georgia, June 20, 1924. Fodderstack Mt., Macon County, NORTH CAROLINA, June 22, 1924 (TYPE). Sunset Rock, Highlands, Macon County, N. C., June 24, 1924. Satula Mt., Macon County, N. C., June 20, 1924. All *W. W. A.*

Related to *V. pallidum* Ait., with which at high altitudes it is often associated and from which it differs in the thinner, smaller and extremely narrowed leaves which are prevailingly entire. Flowers unknown.

VACCINIUM MARGARETTAE Ashe, which was originally reported from Rabun County, Georgia, has recently been found (W. W. A., June 1930) in Jackson County, Alabama, where it is not uncommon upon the Cumberland Plateau about ten miles south of the Tennessee State line.

VACCINIUM ATROCOCCUM var. **Longianum**, var. nov. A typo recedit baccis glaucis.

Flowers and habit of shrub as in the typical form, but fruit glaucous. —TYPE (in herb. W. W. A.): *F. W. Pennell and Bayard Long*, no. 7592, June 26, 1912, serpentine barrens, Paoli, Chester County, PENNSYLVANIA, where numerous collections of this form have been made.

VACCINIUM FUSCATUM var. **pullum**, var. nov. A typo differt foliis minoribus, crassis et oblongis.

The plate of *V. formosum* Andr. (Bot. Rep. *t.* 97. 1797) which refers to Aiton's description of the same cultivated plant upon which *V. fuscatum* Aiton (Hort. Kew. I, **2**: 11. 1789) is based, shows a plant with relatively large ovate leaves. This is the prevailing form of *V. fuscatum*. In the lake region of Marion County, Florida, especially in the vicinity of Sellers Lake, the common form which seems to occur rarely elsewhere, has small thick oblong leaves, 2–3 cm. long, 1–1.5 cm. wide, acute at each end with revolute margins. TYPE: May 14, 1929, Marion County, FLORIDA, *W. W. A.*

DECAMERIUM

Nuttall[1] called attention to the characters which separate a group of eastern North American *Vacciniaceae* typified by *Vaccinium frondosum* L. from *Gaylussaccia* and proposed for this group the name *Decamerium*.[2] *Gaylussaccia* HBK.[3] is based upon a South American shrub having a 10-celled drupe, sulcate with 10 grooves; scant foliage, the leaves with a prominent apical gland, and scarlet flowers in axillary racemes. As early as 1839 Dunal[4] listed 29 species having these characters all but one (from Java) in South America, most of them in tropical Brazil. It seems to form a well defined tropical genus contrasted with *Thibaudia* from which it was held to differ as *Arctostaphylos* differs from *Arbutus*.

Nuttall transferred to his proposed genus *Vaccinium frondosum* L.; *V. resinosum* Ait.; *V. hirtellum* Ait.; and *V. dumosum* Andr.

The following additional species should be transferred:

DECAMERIUM **brachycerum**, comb. nov. *Vaccinium brachycerum* Michx. Fl. Bor. Am. **1**: 234. 1803. *Gaylussaccia brachycera* Gray Man. 259. 1848.

[1] Am. Phil Soc. **8**: 259. 1843.

[2] The name *Decachaena* was suggested by Torrey and Gray (ex Gray in Am. J. Sci. **42**: 43. 1841) for the group to which Nuttall applied the name *Decamerium* but the name apparently was given only a subgeneric significance. "Several of the more common species" (of *Vaccinium*) "which I have cursorily examined, exhibit a more or less completely 8–10-celled ovary, but with many ovules in each cell. There is a small group, however (*Decachaena, Torr. & Gray ined.*) presenting a different structure which is best exemplified in *V. resinosum* Ait."

It scarcely seems possible to consider *Adnaria* Raf. (Flo. Lud. 56. 1817) as referring to this group although it is suggested by Britton and Brown. The characters which Rafinesque mentions and which might point to *Gaylussaccia* or *Decamerium* are applicable to *Vaccinium*, "stamina 10, disco glanduloso inserta" and "bacco 5-locularis?" but for the further statement that the proposed genus is "intermediary between the genera Oxycoccus and Vaccinium." The genus is based upon a species having leaves glabrous, "with a few teeth, flowers 2–3 together"; "a shrub 9 ft. high, growing in swamps." No eastern North American representative of the group under consideration seems to meet this description although several species were known to Rafinesque.

[3] Nov. Gen. **3**: 275. 1818.

[4] In D.C. Prod. 7, pt. 2: 556 et seq.

Decamerium **nanum**, comb. nov. *Gaylussaccia frondosa* var. *nana* Gray Syn. Fl. N. A. Ed. 2, 2: pt. 1, 396. 1886. *Gaylussaccia nana* Small in Bul. Tor. Cl. 24: 443. 1897.

Decamerium **tomentosum**, comb. nov. *Vaccinium tomentosum* Pursh in Gray's Syn. Fl. **2**: pt. 1: 19. 1878 (as synonym). *Gaylussaccia frondosa* var. *tomentosa* Gray Syn. Fl. N. A. **2**: pt. 1: 19. 1878.

Decamerium **ursinum**, comb. nov. *Vaccinium ursinum* M. A. Curtis in Am. J. Sci. **44**: 82. 1843. *Gaylussaccia ursina* T. & Gr. in Gray in Mem. Am. Acad. (II), **3**: 49. 1846.

Decamerium hirtellum (Ait.) Nutt. This plant is commonly considered as being deciduous but in all spring collections made in west Florida the old leaves persist until the new ones are developed. The drupe, seeming undescribed, is black, 5–9 mm. thick and glandular-hispid. The species is variable. The most distinct form is

D. hirtellum var. **griseum**, var. nov. Folia molliter pubescentia et plerumque obovata.

Leaves prevailingly obovate, sometimes oblong, 3–4 cm. long, both faces as well as the twigs, rachis and pedicels soft-pubescent with short grayish hairs but calyx glandular-hispid as in the type. 5–7 dm. high —Titi swamps with slash pine, the southwestern part of Okaloosa County, Florida. Type: *W. W. A.* Apl. 19, 1923.

In the grassy pine barrens in the same portion of this county there is a dwarf form (forma **minimum**, n. f.) of the same species about 1 dm. high sparingly hispid, or even glabrate except for the calyx which is as in the type. Type: *W. W. A.* Apl. 19, 1923.

Washington, D. C.

Mountain Laurel (Kalmia latifolia) at Cherryfield, Maine. —On another occasion[1] the writer has called attention to a little-known report of the occurrence of *Kalmia latifolia* at Cherryfield, Maine.

This report was published about eighty-seven years ago by Aaron Young, Jr.,[2] and a specimen of the plant from Dr. Young exists in the Parker Cleaveland collection in Bowdoin College, where, through the courtesy of Dr. Manton Copeland, it was examined some years ago by the late Dr. Dana W. Fellows and the writer.

Since finding this record and viewing the specimen in the Bowdoin collection, the writer has felt much interest in this out-lying station for a plant which is very local in the state, and he has made many inquiries concerning the place of its occurrence.

[1] 1913, Norton, Rhodora, 15, 142.

[2] 1843, Young, Bangor Daily Whig and Courier (spring or early summer).

It seems that half a century ago, more or less, the plant was quite abundant there, and the flowers in considerable demand for decoration. Then the place was much resorted to, at the flowering season. Through extensive picking, lumbering operations and a forest fire, it has been greatly reduced in extent, and now the place is very seldom visited. It is said that very few persons now know the location of the place, though a general knowledge exists that some "flower" of rare beauty occurs in "The Devil's Garden."

While attending the field meeting of the Josselyn Botanical Society at Beddington, in July 1930, only about twenty miles from Cherryfield, it was deemed worthwhile to make an effort to rediscover this long-forgotten station. On July 8, securing for a guide one of the few local men acquainted with the place, a party composed of Mr. and Mrs. Ralph C. Bean, Miss W. A. A. Fiske, Miss Sue L. Gordon, Mr. H. M. W. Haven, Miss Annie Nichols and the writer, visited the place and secured specimens to re-establish the station. The location is about three miles northeast by east from Cherryfield village, on the southern edge of a swampy tract in mixed second growth, and is much shaded by the trees. But three or four plants were in flower this year, and we found no evidence to indicate further flowering for the season.

Several small patches of the plant exist now, in a space of about a quarter of an acre, though the guide declared that the plant is again increasing.—Arthur H. Norton, Portland Society of Natural History.

The Home of Kerria japonica.—On p. 29 I published a map (map 3) indicating that *Kerria japonica* is indigenous only in China, and in a footnote I said: "*Kerria japonica* DC., in spite of its specific name, is endemic in China." My friend, Professor Nakai, however, writes from Tokyo: "*Kerria* is also indigenous to Japan. It has simple flowers nearly always and rarely semi-double flowers. The genuine double-flowered form which is known as Tai Tan Hoa by Chinese, as Yae-yamabuki by Japanese, might have been imported to Japan from China, yet the history is unknown. *Kerria* grows wild among bushes on the lower slopes of mountains, on hills, and on the plains of Hondo, Shikoku and Kiusiu. Its occurrence wild in Korea is not ascertained as yet." My error arose through reliance on the statements of the great specialist on the *Rosaceae*, Focke, and of two

of the recognized authorities on the woody plants of eastern Asia. Focke says of *Kerria:* "Aus den Gärten Ostasiens in Europa eingeführt, namentlich in einer Sorte mit gefüllten Bl.; wildwachsend an wenigen Stellen in China gefunden."[1] Schneider implies that it is native of China and cultivated or wild elsewhere, saying: "China: Kiangsi, Hupei, Sz'tschwan; sonst in ganz O.-As. seit alters kultiviert und verwildert."[2] Rehder, similarly, says of the monotypic *Kerria* "One species in China,"[3] without mentioning Japan. Dr. Nakai's letter, however, indicates that the geographic range of the indigenous shrub inferred from these statements is incomplete.—M. L. FERNALD.

1 Focke in Engl. & Prantl, Pflanzenr. iii[3]. 28 (1894).
2 Schneider, Handb. Laubholzk. i. 502 (1904).
3 Rehder, Man. Cult. Trees and Shrubs, 407 (1927).

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Rhodora

JOURNAL OF

THE NEW ENGLAND BOTANICAL CLUB

Vol. 34. October, 1931. No. 394.

NOTES ON LYCOPODIUM INUNDATUM AND ITS ALLIES IN THE WESTERN HEMISPHERE

I. A New Variety of Lycopodium inundatum

Richard J. Eaton

Several years ago, the writer discovered in Concord a small colony of a *Lycopodium* which closely resembled *L. alopecuroides* L. Growing compactly in the midst of an unusually profuse stand of *L. inundatum* and var. *Bigelovii*, it contrasted conspicuously with its more orthodox neighbors. Particularly noticeable were the stout, tall (14–17 cm.) fertile branches, terminated by large strobiles (nearly 2 cm. thick) with long-attenuate, horizontally spreading sporophylls. The spreading-ascending leaves of the peduncle were notably longer and more crowded than the distant, sub-appressed peduncle-leaves of typical var. *Bigelovii* growing near by. The leaves of the sterile branches, both in arrangement and size, were similar to those of typical *L. inundatum*, but more conspicuously denticulate, the teeth in some instances occurring well beyond the middle of the leaves. There was no suggestion of that hairy aspect of the sterile stems which is so characteristic of *L. alopecuroides* from the southern coastal plain where the latter species reaches its most distinctive development.

A more critical examination of the Concord plant reveals sporophyll characters which at once establish its close relationship to *L. inundatum*. Sporophylls dissected from the middle portion of a strobile are 8–9 mm. long, tapering gradually to an attenuate point from a base 1.5 mm. wide, and bear from 4–6 bristle-like teeth more or less clustered above the spore-case, but not extending beyond the middle

of the bract. In typical *L. alopecuroides*, the sporophylls are narrower at the base (0.75–1.25 mm. wide) and are beset with 6–10 (or sometimes more) bristle-like teeth rather evenly distributed from the base upwards beyond the middle, occasionally extending more than three-fourths the entire length of the bract.

Thinking the Concord plant to be perhaps a transient sport or an ecological form of *L. inundatum* with which it is so closely associated, I have kept the station under close observation for the past three years. The colony, consisting of perhaps a half dozen plants when first discovered, shows a marked tendency to increase. Last fall (1930) it covered an area of nearly a square meter and contained several dozen well-matured and characteristic specimens. Obviously, we are confronted with a self-perpetuating form with such distinctive characters as to deserve varietal rank. It is here proposed as

Lycopodium inundatum L., var. **robustum**, var. nov., formae typicae simile, sed omnibus partibus robustius; caulibus sterilibus 0.5–2 dm. longis (aliquando longioribus) arcuantibus diametro 2 mm.; foliis 5–6 mm. longis sursum curvatis aliquando radialibus saepe supra medium denticulatis; pedunculis diametro 2–2.5 mm. foliosis, foliis multis patenti-adscendentibus 6–8 mm. longis; strobilis maturis sporophyllis ad libram patentibus inclusis 1.4–1.7 cm. latis, 5–7 cm. longis; sporophyllis 7–9 mm. longis e basi latiuscula circa 1.5 mm. lata gradatim attenuatis 4–6 dentibus setisve marginalibus totis inter sporangium et sporophylli mediam partem approximatis onustis.

Similar to the typical form but much larger in every dimension. Sterile stems 0.5–2 dm. long (occasionally longer), arching, 2 mm. in diameter. Leaves 5–6 mm. long, curved upward, sometimes radial, denticulate (frequently above the middle). Peduncles 2–2.5 mm. in diameter, leafy; peduncle-leaves numerous, spreading-ascending, 6–8 mm. long. Mature strobiles, including the *horizontally* spreading sporophylls, 1.4–1.7 cm. wide and 5–7 cm. long. Sporophylls 7–9 mm. long, attenuate, gradually tapering from a rather broad base about 1.5 mm. wide, beset with 4–6 marginal teeth or bristles clustered between the spore-case and the middle of the bract.—Massachusetts to New Jersey, chiefly along the coastal plain.

A detailed study of local collections of the *L. inundatum-alopecuroides* group in the Gray Herbarium, and in the herbaria of the New York Botanical Garden, Brooklyn Botanic Garden and New England Botanical Club suggests that typical *L. alopecuroides* has yet to be discovered on the mainland north of New Jersey. In particular, it appears that the following specimens, now passing as this species, should be referred to *L. inundatum* var. *robustum:*

Barnstable, Mass.	*M. L. Fernald,*	No. 8381	31 July,	1913	N.E.B.C.
" "	"	15851	7 Oct.,	1917	"
" "	*Fernald & Long,*	15939	4 Sept.,	1918	"
Milford, Conn.	*E. H. Eames*	5860	13 Oct.,	1907	Gray
Tom's River, N. J.	*L. H. Lighthipe*		1 Sept.,	1890	N.Y.B.G.
Shark's River, N. J.	*H. Edwards*		Aug.,	1886	"

In addition, the following sheets likewise should be so designated:—

Sheffield, Mass.	*R. Hoffman*	25 Sept.,	1899	N.E.B.C.
Concord, Mass	*R. J. Eaton*	15 Sept.,	1928	"
" "	"	28 Sept.,	1930 (TYPE)	"

Occasional collections from Long Island and Nantucket appear to be somewhat depauperate specimens of genuine *L. alopecuroides*, as for instance:—

Babylon, L. I.	*W. N. Clute*	No. 360	8–9 Sept.,	1898	N.Y.B.G.
" "	"		20 July,	1899	Herb. L. Griscom
Nantucket, Mass.	*L. L. Dame*		Aug.,	1886	N.E.B.C.
" "	*J. R. Churchill*		7 Sept.,	1909	"

As an example of the confusing status of the group in New Jersey, a specimen collected by *P. Wilson* at Tom's River, New Jersey, 9 September, 1915 (New York Botanical Garden), corresponds in every detail with the best material from the southern coastal plain, whereas a plant collected as *L. alopecuroides* by Wilson at the same locality eight days earlier shows leaf- and sporophyll-characters of *L. inundatum* var. *robustum.*

In general, there are no clearly defined lines of demarcation separating *L. inundatum* and the two varieties, one from another. Apparently the variety *robustum* in its typical development is an uncommon plant. Many extreme forms of the species and variety *Bigelovii* approach it in one or more particulars, but usually resolve into their true categories, on balance, as it were.

Boston, Massachusetts.

NEW PLANTS FROM OREGON

L. F. Henderson

Juniperus Californica, var. **Siskiyouensis**, var. nova. Differt a forma typica foliis minoribus, subtus albis; amentis masculis minoribus, antheris circa 14; strobilis globoso-oblongis, minoribus; testa valde indurata; cotyledonibus 5–6.—Summit of the Siskiyou Mountains, near Highway, Jackson County, April 23, 1930. My no. 12483.

Associated with *Juniperus occidentalis* and easily mistaken for it. It differs from *J. Californicus*, var. *Utahensis* in leaves very glandular; berries oblong, reddish-yellow, with scarcely evident scales, 8–10 mm. long. Very few fruits were found this year, but in all examined the cotyledons were found to be 5–6.

Calochortus Greenei, var. **calvus**, var. nova. Differt a forma typica sepalis intra et infra calvis; petalis valde inarctatis etiam conniventibus; sepalis basi papillosis, non "capillos gerentibus."—South slope of Siskiyou Mountains, in brushy land or open, Jackson County, near the California line, July 12, 1930. My no. 12809. Type in Herb. Univ. of Oregon.

This may prove to be a new species rather than a variety, but it bears so close a resemblance in strongly papillate scales and hairs to *C. Greenei*, which was discovered in Siskiyou County, California, only three miles (on its northern line) from where my plant grew, that I prefer, at least for the present, to consider it a well-marked variety. The colors of flowers are also the same.

Draba aureola, var. **paniculata**, var. nova. Planta non simplex, sed supra folia congesto-ramosa.—Type in the Herbarium of the University of Oregon, collected by me on the North Sister of the Three Sister Mountains in August, 1881, and by many others since. My no. 13494.

This branching form seems to be the only one on the Three Sister Mountains of Oregon, though specimens from Mt. Rainier in Washington are unbranched!

Cogswellia utriculata, var. **papillata**, var. nova. Fructus papillis 1-multi-loculatis indutus; valleculae 1-vittatae, commissura 4–6-vittata.—Siskiyou Mountains near the California line in Jackson County, and elsewhere, June 12, 1930. My no. 12614. Type in the Herbarium of the University of Oregon.

Found in many places, often with the glabrous form. Possibly the number of vittae varies from the number stated.

Dicentra formosa, var. **breviflora**, var. nova. Flos cordato-rotundus, fere tam latus quam longus.—Mirror Lake, south of Mt. Hood, where found by *Mr. and Mrs. J. R. Leach*, July 24, 1927. Their no. 1360. Type in the Herbarium of the University of Oregon.

I can find no way in which this plant differs from the common *D. formosa* save in its remarkably short flowers, 10 mm. wide by 12 mm. long.

Rosa spithamea, var. **solitaria**, var. nova. Differt a forma typica floribus semper solitariis; tota planta magis glandulosa; dentibus

foliorum denticulatis et valde glandulosis; setis fere nullis.—Road from Diamond Lake to North Umpqua River, alt. 5000 feet, Douglas County, July 9, 1930. My no. 13238. TYPE in the Herbarium of the University of Oregon.

The glandular-denticulate leaf-teeth are things of beauty. Hundreds of flowers were seen and a dozen or more collected, and all solitary on the stems. From Jepson's var. *sonomensis* it differs in single flowers and almost complete absence of bristles.

RHODODENDRON **Leachianum**, sp. nov. Frutex valde ramosa, 6–10 pollicaris; foliis oblongo-obovatis, supra glabris vel apice tenuiter lepidotis, ½–1-pollicaribus, subtus lepidoto-punctatis, acutis vel obtusis, sempervirentibus, rigidis; floribus corymboso-umbellatis, longe pedicellatis, gemma quaque singulis; calyce rubro, 4–5 mm. longo, lobis ovatis obtusis; corolla rosea, imo alba vel albescente, 10 mm. longa, 12–15 mm. lata, lobis tubo aequantibus vel eo longioribus, obtusis, extus lepidotis; staminibus corollam aequantibus vel superantibus, filamentis glabris, antheris oblongis, poris dehiscentibus; ovario valde flavo-lepidoto, 5-loculoso, compresso vel hemispherico, nunquam pyramidato; seminibus fuscis vel flavis, ellipticis, 0.5 mm. longis.—Flowering in May and June, according to elevation. When first discovered in 1930 by *Mr. and Mrs. J. R. Leach* (their no. 2915), only a small patch was found, in the higher Siskiyou Mountains of Curry County, Oregon, and no good fruit was obtained. On a second trip this year (1931) it was found to be abundant in dry, rocky ground on Horse Sign Butte and along Collier Bar Trail, alt. 2000–4000 feet, in the same county; and in this collection is much good fruit of last year's crop. TYPE in the Herbarium of the University of Oregon; cotypes in the Gray Herbarium, Herbarium of the Arnold Arboretum and elsewhere.

This plant seems to me to stand very near to *Rhododendron Lapponicum*, but it differs in larger obovate to elliptic leaves generally perfectly smooth above or with few scales at the tip, though very lepidote-punctate below; slightly wider corolla; calyx red and 3–4 mm. long; pedicels merely glandular; and capsule hemispherical or even obcompressed, very different in form from the pyramidal capsule of *R. Lapponicum*. I take great pleasure in naming this unique plant for the discoverers, zealous collectors and mountain lovers of Portland, Oregon, who have discovered several new plants, including one new genus.

NAVARRETIA **Savagei**, sp. nova. Planta simplex 6–15 cm. alta, erecta, basi glandulosa ubi magis pubescenti, supra caule, foliis, bracteis, et calycibus glanduloso-villosa; foliis 1–2 cm. longis, infra bipinnatis, supra tenuiter pinnatis, lobis albo-aciculatis; bracteis

similibus sed simplicioribus; calyce nunc lobis simplicibus, nunc inaequaliter trilobatis; corolla tenebroso-coerulea vel purpurea, anguste infundibuliforme supra medium, haud calycem excedente; staminibus paulo longe exsertis, supra curvatis; capsula 2–3-seminibus, sed horum unum solum maturante, basi quattuor valvis dehiscente, sed apice cohaerente et apiculata, rotundata sed 4-angulata, 1-loculata; semine magno, ruptam capsulam tollente, ad extremum profunde excavato.—Moist rocky flats, Sam's Valley, Jackson County, which later becomes very dry, June and July; fruit September. My no. 12979. Type in the Herbarium of the University of Oregon.

I take great pleasure in dedicating this little plant to my friend Lincoln Savage of Grant's Pass, Oregon, who, as companion and amateur botanist, has rendered me much assistance. Any one who has followed the above description of this plant will see that it is so close to Greene's *N. mitracarpa* that further study may prove it to be merely a variety of his species. But as seen in Sam's Valley, several hundred miles from Colusa County, California, its slender, unbranched, upright stems; the more numerous segments of the leaves and their more compound form; its more divided calyx-lobes; its rather wider, uncinate seed with deep uniform excavation; and finally its habitat—these all show specific characteristics rather than varietal.

Pentstemon deustus, var. **suffrutescens**, var. nova. Differt a forma typica basi suffrutescenti vel frutescenti; altitudine majora; foliis longioribus, magis laciniatis; stamine quinto valde hirsuto.—Dry bars of Rogue River, above Agness, Curry County, June 30, 1929. Collected by *Mr. and Mrs. J. R. Leach*, their no. 2550. Type in the Herbarium of the University of Oregon.

Another interesting form of this polymorphous species, looking quite distinct from typical *P. deustus;* but connecting forms are found.

Pentstemon deustus, var. **Savagei**, var. nova. Differt a forma typica corolla purpureis limitibus maculata, extra glandulosa; lobis calycis attenuato-circinatis.—At middle elevations, Bluffs of Grayback Mountain, Josephine County, July 13, 1930. My no. 12828. Type in the Herbarium of the University of Oregon.

It has been apparent to the author, as it has been to most botanists who have studied *Pentstemon deustus*, that it would have to be divided into many varieties, or else species would be made of these forms. In spite of the differences given above, the general similarity and peculiar odor of all these forms would rather link them as varieties than species. In no other variety, nor in typical *P. deustus*, do these handsome and well marked stripes on the corolla appear.

University of Oregon.

Photo. H. M. Raup.

Rubus Kennedyanus.

Photo. H. M. Raup.

RUBUS PERGRATUS, var. TERRAE-NOVAE.

FURTHER NOTES FROM SOUTHWESTERN NEWFOUNDLAND

R. B. Kennedy (Mrs. Sinclair Kennedy)

(Plates 216 and 217)

From June 1 to September 15, 1930, I was able to collect, as during the previous summer, along some of the salmon streams of southwestern Newfoundland. Thanks to Professor Fernald's study of my specimens, I can report the following species and varieties.

I. Plants already known, but very locally, from western Newfoundland:

Najas flexilis Rostk. & Schmidt. Highlands Pond (near Crabbes Station). Previously known from Curling and from near Red Indian Lake.

Juncus longistylis Torr. Mouth of Barachois Brook. Previously reported from the Over-fall and from Governor's Island (Bay of Islands).

Cypripedium parviflorum Salisb. Harry's Brook at Black Duck. The common plant of limestone barrens and cliffs in western Newfoundland is var. *planipetalum* Fernald.

Subularia aquatica L. Highlands Pond. Previously known from Curling.

Aster foliaceus Lindl., var. geminata Fernald. Bluff on coast at Highlands. Previously known only from the type-station on Table Mt., Port-au-Port.

II. Plants already known in Newfoundland but only in the eastern or central sections, hence interesting as connecting links with the continental ranges:

Luzula campestris DC., var. acadiensis Fernald. Black Duck. Previously known from the valley of the Exploits.

Hypericum ellipticum Hook. Crabbes Brook. Local stations previously known, from St. John's to Harbor Breton.

III. Plants of continental eastern North America, new to Newfoundland:

Lonicera villosa (Michx.) R. & S., var. tonsa Fernald. Crabbes Station. Heretofore known only from Connecticut, Massachusetts and Maine.

Aster paniculatus Lam. Near Highlands Pond.

IV. Old World species not known elsewhere in eastern America, new to Newfoundland:

Festuca longifolia Thuill., var. —? Harry's Brook, at Black Duck. A European species not hitherto recorded as American. Professor Fernald states that my material is unusually pubescent.

Ranunculus Gmelini DC. Mouth of Robinson's Brook. Primarily an Asiatic species, heretofore known from Russia to Kamtchatka, and reported from Alaska.

V. Plants hitherto undescribed.

Professor Fernald has supplied the following descriptions and Dr. H. M. Raup the photographs.

Rubus **Kennedyanus** Fernald, n. sp. (tab. 216), suberectus gracilis; turionibus 2–4 mm. diametro aculeis 2–3 mm. longis aciculiformibus rectis divergentibus subremote armatis, setis glanduliferis nullis; foliis quinquefoliolatis longe petiolatis, petiolis remote armatis, foliolis valde inaequalibus subtus minute pilosis vel glabratis caudato-acuminatis anguste duplicato-serratis imis anguste ovalibus 4–5 cm. longis basi angustatis, terminalibus ovatis, 7–9 cm. longis basi rotundatis vel cordatis, petiolulis armatis pilosis mediis brevissimis terminalibus 1–2 cm. longis; foliis trifoliolatis subtus minute pilosis, foliolis ellipticis caudato-acuminatis 2.5–5.5 cm. longis anguste duplicato-serratis; inflorescentia corymbiformi basi foliosa; rhachibus pilosis inarmatis; pedicellis filiformibus adscendentibus pilosis inarmatis 1–1.5 cm. longis; sepalis oblongo-ovatis pilosis valde caudatis; petalis fructibusque ignotis.—Newfoundland: near Highlands Pond, Crabbes, St. George District, August 8, 1930, *R. B. Kennedy*, no. 445 (type in Gray Herb.).

In its very slender (and apparently low) bristly canes and its corymbiform inflorescence (of only 3–5 flowers) *Rubus Kennedyanus* suggests the continental *R. vermontanus* Blanchard and *R. abbrevians* Blanchard. From them both it is at once distinguished by the very prolonged leaf-tips, much finer and prolonged serration and by the remarkably long slender tips (2–3 mm. long) of the sepals. It seems to be a quite distinct Newfoundland type, with which it is a great pleasure to associate the name of its discoverer, an amateur who has gone to unusual pains to secure a complete series of the plants of St. George District and has brought to light a notable group of additions to the known flora of Newfoundland. The photograph (Plate 216) is two-thirds life-size.

Rubus pergratus Blanchard, var. **terrae-novae** Fernald, n. var. (tab. 217), foliolis foliorum trifoliolatorum anguste subrhomboideo-obovatis basi cuneatis apice obtusis vel subacutis.—Newfoundland: along the railroad north of Black Duck, Harry's Brook (or River), St. George Distr., July 17, 1930, *R. B. Kennedy*, no. 377 (type in Gray Herb.).

R. pergratus, var. *terrae-novae*, as shown by Mrs. Kennedy's material, is apparently lower and more slender than well developed con-

tinental *R. pergratus*, but some specimens of the latter are as slender. In its prickles, 5-foliolate leaves and pubescence it is easily matched on the continent, and its leafy-bracted raceme, with flowers borne even in the lowest axils, is characteristic of *R. pergratus*. In the latter, however, the leaflets of the 3-foliolate leaves are lanceolate to ovate, rounded at base and usually slender-tipped. The 5-foliolate leaf and a raceme of var. *terrae-novae* are shown in Plate 217, at two-thirds life-size.

Patterson, Putnam County, New York.

Explanation of Plates 216 and 217

Plate 216. Rubus Kennedyanus × ⅔, from the type-collection. Plate 217. Rubus pergratus, var. terrae-novae × ⅔, from the type-collection. Both photographs by *H. M. Raup*.

POTAMOGETON TENUIFOLIUS RAF.

M. L. Fernald

In 1930 I showed[1] that the North American and eastern Asiatic plant which had long passed as the Eurasian *Potamogeton alpinus* Balbis differs in many points, especially in its fruit, from true *P. alpinus*. At that time I took up for it the earliest specific name which had been associated with it by Bennett, Graebner, Hagström and other monographers of the genus: *P. microstachys* Wolfg. (1827). As I then remarked, the name given by Wolfgang was an inappropriate one for a species "with mature spikes 1.5–3.5 cm. long and 7–10 mm. thick," but it arose through the fact that Wolfgang had spikes not yet in flower. The misleading name, it now proves, cannot be maintained, since it is antedated by sixteen years by the valid *P. tenuifolius* Raf. Med. Repos. hex. 3, ii. 409 (1811).

In *Index Kewensis*, Rafinesque's name appears in the italic type of species not maintained and with the query "Quid?"; and the name has been resting in general oblivion, except that Hagström ventured the guess that it "Might be *gramin*[*eus*] L.—ff. without floating leaves—and *Zizii* M. & K."[2] Rafinesque, however, rested his *P.*

[1] Fernald, Rhodora, xxxii. 76–83, t. 197 (1930).

[2] Hagström, Crit. Res. Pot. 279 (1916).

tenuifolius on a foundation quite as secure as those of his *P. epihydrus, diversifolius, foliosus* and *borealis*, which were all based on descriptions or diagnostic phrases of Michaux and which have all been regularly taken up. The name under discussion was published as follows:

1. Potamogeton tenuifolium. (Raf.—*P. lucens*, M. fl. bor. Am. *nec non Linn.*) caule longissimo, foliis lanceolatis subsessilibus, integerrimis, acutis, spicis cilindricis.—America boreali.

The account of *Potamogeton lucens* in Michaux, Fl. Bor.-Am. i. 101 (1803) was as follows:

LUCENS. *L.* P. foliis lanceolatis, subsessilibus, basi quasi in petiolum angustatis: spicis longo-cylindricis.
Obs. Nostrate quadruplo minus: foliis integerrimis, non acuminatis.
Hab. in amnibus ad lacus *Mistassinos* affluentes et inde ad sinum *Hudsonis* defluentes.

My memorandum of 1903, when I studied Michaux's herbarium, indicated that his plant of Lake Mistassini was the American plant passing as *P. alpinus;* but only very recently have I noted that Michaux's material must be taken as the type of the heretofore unidentified *P. tenuifolius* Raf. In order to verify my earlier decision I appealed to Professor H. Lecomte of the Muséum d'Histoire Naturelle at Paris. Professor Lecomte most kindly looked into the matter and his reply is self explanatory: "je vous envoie deux croquis *calques* par Mlle. Vesque sur la plante de Michaux. L'étiquette porte l'inscription suivante:

Potamogeton fol. lanceolatis in petiolos desinentibus. *P. lucens.* Riv. Mistassin.

La feuille porte deux échantillons (A à droit de la feuille, B à gauche)."

Mlle. Vesque's exquisite drawings show specimen B to be a fruiting plant of very characteristic *P. microstachys* Wolfg. (1827) or *P. obrutus* A. Wood (1847); and the enlarged drawings of the mature fruits of specimen B are absolutely conclusive. Specimen A, only in bud, is equally characteristic *P. microstachys*, var. *subellipticus* Fernald (1930). It is thus quite clear that we must replace the inappropriate name *P. microstachys* by the wholly appropriate *P. tenuifolius.* The bibliography is as follows.

POTAMOGETON TENUIFOLIUS Raf. Med. Repos. hex. 3, ii. 409 (1811). *P. lucens* Michx. Fl. Bor.-Am. i. 101 (1803), not L. *P. microstachys* Wolfg. in Schultes & Schultes, Mant. iii. 360 (1827). *P. rufescens,* "Forma angustifolia" from Unalaska, Cham. in Cham. & Schl.

Linnaea, ii. 211 (1827). *P. obrutus* A. Wood, Cl-Bk. ed. 2: 525 (1847). *P. alpinus*, proles *microstachys* (Wolfg.) Graebn. in Engler, Pflanzenr, iv[11]. 72 (1907). *P. microstachys*, var. *typicus* Fernald, RHODORA, xxxii. 80, t. 197, at right (1930).

P. TENUIFOLIUS, var. **subellipticus** (Fernald), n. comb. *P. microstachys*, var. *subellipticus* Fernald, RHODORA, xxxii. 82 (1930).

GRAY HERBARIUM.

A COLOR VARIATION IN POTENTILLA TRIDENTATA.—On the northeast side of Isle au Haut, about a half mile north of the post office, on June 19, 1931, my attention was caught by a plant with pink flowers growing in a field by the roadside. A closer view showed that it was a typical *Potentilla tridentata* in all but color. The tint was pale toward the tips of the petals and increased to quite a deep pink at the centers. No other pink-flowered plants of the species were observed on the island, neither near the sea nor in the interior on Mount Champlain.

POTENTILLA TRIDENTATA Ait., forma **aurora,** n. f., petalis pallide rubris.—MAINE, Isle au Haut, Knox County (TYPE deposited in New England Botanical Club Herbarium).—JEANNETTE E. GRAUSTEIN, Women's College, Newark, Delaware.

HOLOSTEUM UMBELLATUM IN RHODE ISLAND.—On May 10, 1931, Mr. C. A. Weatherby and I found a small, chickweed-like plant growing in the edges of lawns, along the Cliff Walk at Newport, Rhode Island. This plant subsequently proved to be *Holosteum umbellatum* L. which has been naturalized from Europe in the Atlantic coastal States farther south, but which has not been reported as growing in Rhode Island, and only once or possibly twice before in New England. Mr. Hunnewell collected this weed at Pomfret, Connecticut, in 1924. In a note in RHODORA[1] he discussed a former, somewhat doubtful report, by Miss Emily J. Leonard, of its occurrence in that State. So far as I have been able to ascertain, these are the only records of *Holosteum umbellatum* in New England.—W. A. ANDERSON. The State University of Iowa.

[1] RHODORA, xxvi. 199 (1924).

Wild Flowers of Kashmir.—The relationship between the eastern American and the eastern and central Asiatic floras is so well known that any work which accurately portrays the plants of one of the areas is of interest to botanists in the others. The third volume of Mr. Coventry's[1] reproductions from autochrome photographs, with the accompanying text, has recently come to hand. Here are beautifully pictured members of many genera familiar in New England: *Anemone, Thalictrum, Aquilegia, Corydalis, Lathyrus, Potentilla, Campanula, Gentiana, Cynoglossum, Pedicularis, Iris* and several others. These volumes are most attractive and the colors are unusually good. We wish that the beauty of our rarer plants could be similarly made known.—M. L. F.

A Condensation of Gerarde's Herball.—One of the most delightful works in Elizabethan English is available only to the limited number of persons who possess or have access to *The Herball or General Historie of Plants Gathered by John Gerarde of London Master in Chirurgerie* (1597). Those who love to read Gerarde but who have not access to the original or to the edition of Thomas Johnson (1633) will get some of the flavor, though with many interesting features necessarily omitted, in an abbreviated reprint just issued.[2]—M. L. F.

[1] Wild Flowers of Kashmir (Series III). By B. O. Coventry, F. C. H. With Descriptions and Coloured Illustrations of fifty species reproduced from direct Colour Photographs. London: *Raithby, Lawrence & Co. Ltd. 16s*, postage additional.

[2] Leaves from Gerard's Herball arranged for Garden Lovers by Marcus Woodward. Boston: *Houghton, Mifflin Co.* $3.00.

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Rhodora

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Rhodora

JOURNAL OF

THE NEW ENGLAND BOTANICAL CLUB

Vol. 34. November, 1931. No. 395.

ON THE "PAPILLOSE" ACHENES IN THE GENUS ANTENNARIA

MORTEN P. PORSILD

THE Old World and, consequently, the longest known species: *Antennaria dioica* (L.) Gaertn., *A. alpina* (L.) Gaertn. and *A. carpathica* (Wahl.) Bl. & Fingerh. and their remarkably few trifling aberrations have GLABROUS achenes. This fact has been stated in a few works. Most of the floras and descriptive books, however, do not mention the achenes of *Antennaria* at all; even "old faithful" HARTMAN, who generally in his Handb. Skand. Fl. 11 Edit. Stockholm 1879 gives a brief but fairly correct description of seeds and achenes where nobody else does so, fails here. In North America, where during the last thirty years about 150 new species have been detected and described by such writers as E. L. GREENE, M. L. FERNALD, P. A. RYDBERG, E. NELSON and others and where, accordingly, suitable characters for discerning the often difficult species would seemingly be needed, even the modern floras and handbooks content themselves in stating that the achenes of *Antennaria* are "terete or nearly so." This is curious since the great majority—if not all—of the species in the Atlantic States of U. S. A. have very distinct granular papillae on their achenes, by which character alone the long lasting confounding of American species with the Old World *A. dioica* might have been avoided.

Yet, papillose achenes in *Antennaria* have in some cases been mentioned by American botanists. The following list is probably very incomplete, owing to the present writer's lack of access to the literature. We find:

1897. Pittonia III.	173.	A. neglecta Greene described as having achenes "copiously papillose."
	174.	A. Howellii Greene "papillose granular."
	175.	A. pedicellata Greene "very minutely and sparsely granular."
	184.	A. neodoica Greene "rather coarsely and obviously granular."
1898.	277.	A. "plantaginifolia" (=A. Parlinii Fern.) "nearly destitute of papillae."
1903. Pittonia V.	111.	A. mesochora Greene "globular papillose."
1921. Rhodora XXIII.	295.	A. appendiculata Fern. "papillose."
1924. Rhodora XXVI.	102.	A. subviscosa Fernald "papillose."
		A. isolepis Greene "sparingly papillose" (*Fernald*).

Thanks to the courtesy of Professor Fernald I have been able to investigate a large number of the Atlantic American species of *Antennaria* in well authenticated specimens. I shall here enumerate the cases where I have noticed papillose achenes, as some of them seem not to have been mentioned before.

A. Parlinii Fern. (*A. arnoglossa* Greene). North Berwick, Me., June 12, 1897, *J. C. Parlin*, (2 sheets); Orono, Me., May 30, 1901, *M. L. Fernald* (2 sheets).

Achenes at full maturity (N. Berwick plant) rather large, 1.79–2.07 mm. long, 0.42–0.50 mm. broad. Papillae evenly dispersed over the whole surface, but rather small. (Fig. 1, a.)

A. canadensis Greene, toward var. Randii Fern. Farmington, Me., June 20, 1897, *C. H. Knowlton*.

Achenes not quite mature, 1.20–1.40 × 0.34–0.42 mm. Papillae as in above, probably somewhat larger. (Fig. 1, b.)

A. plantaginifolia (L.) Richards. Stoneham, Mass., May 23, 1895, *W. P. Rich*.

Achenes very young, but evidently papillose.

A. neodoica Greene. Wells Beach, Me., June 22, 1898, *Kate Furbish*.

Achenes mature, 1.29–1.46 × 0.34–0.39 mm. Papillae slightly scarcer in number and longer than in the preceding.

A. neodioica var. rupicola Fern. Island Falls, Me., June 9, 1898, *M. L. Fernald*.

Achenes quite young, but distinctly papillose.

A. neodioica var. gaspensis Fern. Gaspé Co., Qué., *Pl. Exsicc. Gray*. 291.

Achenes immature, rather sparingly papillose.

A. neodioica var. gaspensis Fern. Mt. Pembroke, Matane Co., Que., July 16, 1923, *Griscom & Pease*, 26,058.

Achenes immature, but copiously papillose.

A. petaloidea Fern. Foxcroft, Me., June 6, 1898, *M. L. Fernald*, 2390 (2 sheets).

Achenes well mature, 1.48–1.60 × 0.39–0.48 mm., papillose; Harwich, Mass., May 11, 1919, *Fernald*, 19,243: mostly male specimens, one immature pistillate papillose. (Fig. 1, c.)

A. petaloidea var. subcorymbosa Fern. Pr. Edw. Isl., June 29, 1914. *Pl. Exsicc. Gray*. 292.

Achenes well matured, papillose.

A. PETALOIDEA var. SCARIOSA Fern. Orono, Me., June 3, 1898, *M. L. Fernald.*

Achenes nearly mature, papillose. Same locality, May 30, 1901, *M. L. Fernald.* Achenes immature, papillose.

A. SPATHULATA Fern. St. Johns Island, Newfdl., July 31, 1925, *Fernald et al.*, 29,183.

Achenes mature, 1.23–1.37 × 0.36–0.42 mm., often somewhat angled; base of style longer than in other species, up to 0.20 mm. long; achenes papillose (FIG .1, d.).

A. SPATHULATA var. CONTINENTIS Fern. & St. John. Burnt Cape, Newfdl., July 17, 1925, *Fernald et al.*, 29,184.

Achenes nearly mature, papillose.

As will be seen, all the species here enumerated as well as most of those stated by Greene to have papillose achenes belong to the large-sized groups of species flocking around *A. plantaginifolia* or around *A. canadensis* or *A. neodioica.* Of the small sized species from localities abundant in Arctic types, FERNALD states l. c. as having *glabrous* achenes: A. ALPINA (L.) Gaertn (!); A. SORNBORGERI Fern.; A. CANA (Fern. & Wiegand) Fern. (several sheets!); A. ALBICANS Fern. (!); A. STRAMINEA Fern.; A. PEASEI Fern.

Of the species marked by a (!) I can but verify this statement as shown by specimens kindly sent me by Professor FERNALD. And to the series I can add *A. vexillifera* Fern. from a part of the type collection.

Of *A. straminea* I have not seen the type described in 1914 and redescribed in 1924, RHODORA xxvi. 100, in which last place the achenes are said to be glabrous. But a later collection, also from Newfdl. *Fernald et al.,* 27,187 contains specimens with well matured achenes, 1.40–1.46 × 0.42–0.45 mm. which are very distinctly papillose. Because of the real nature of the "papillae" which will be treated subsequently, I can hardly think that the same species may sometimes have and sometimes lack that character, so there seems to be some mistake in one of the two collections.[1]

Of the species of *Antennaria* thus far known to me from Greenland I have seen papillose achenes in two species, one of which is a rather stout plant seen in a large number of specimens from about 10 localities in West Greenland, ranging from 66°–71° Lat. N. and which I have supposed to be conspecific with *A. subviscosa* Fern., but which Professor FERNALD is treating as a Greenland endemic, *A. affinis* Fern. The other is a dwarfish species from the southernmost parts in

The type of *A. straminea* has glabrous achenes.—M. L. F.

Greenland and in the field confounded with *A. groenlandica* Porsild, the most common *Antennaria* species in this section. I am unable to identify it; it is probably a new species.

Antennaria species of Greenland with glabrous achenes are *A. alpina* (L.) Gaertn., *A. angustifolia* Elis. Ekman, *A. glabrata* (Vahl) Greene, *A. intermedia* (Rosenv.) Porsild, *A. groenlandica* Porsild, *A. Porsildii* Elis. Ekman and two or three still unidentified species resembling Fernald's species *A. vexillifera*,[1] *A. cana* and *A. albicans* respectively.

From the Rocky Mountains of Alberta I have 7 sheets of *Antennaria*, kindly presented by Dr. M. O. Malte. They represent, I think, 4 or 5 species, but they are unknown to me. All have glabrous achenes.

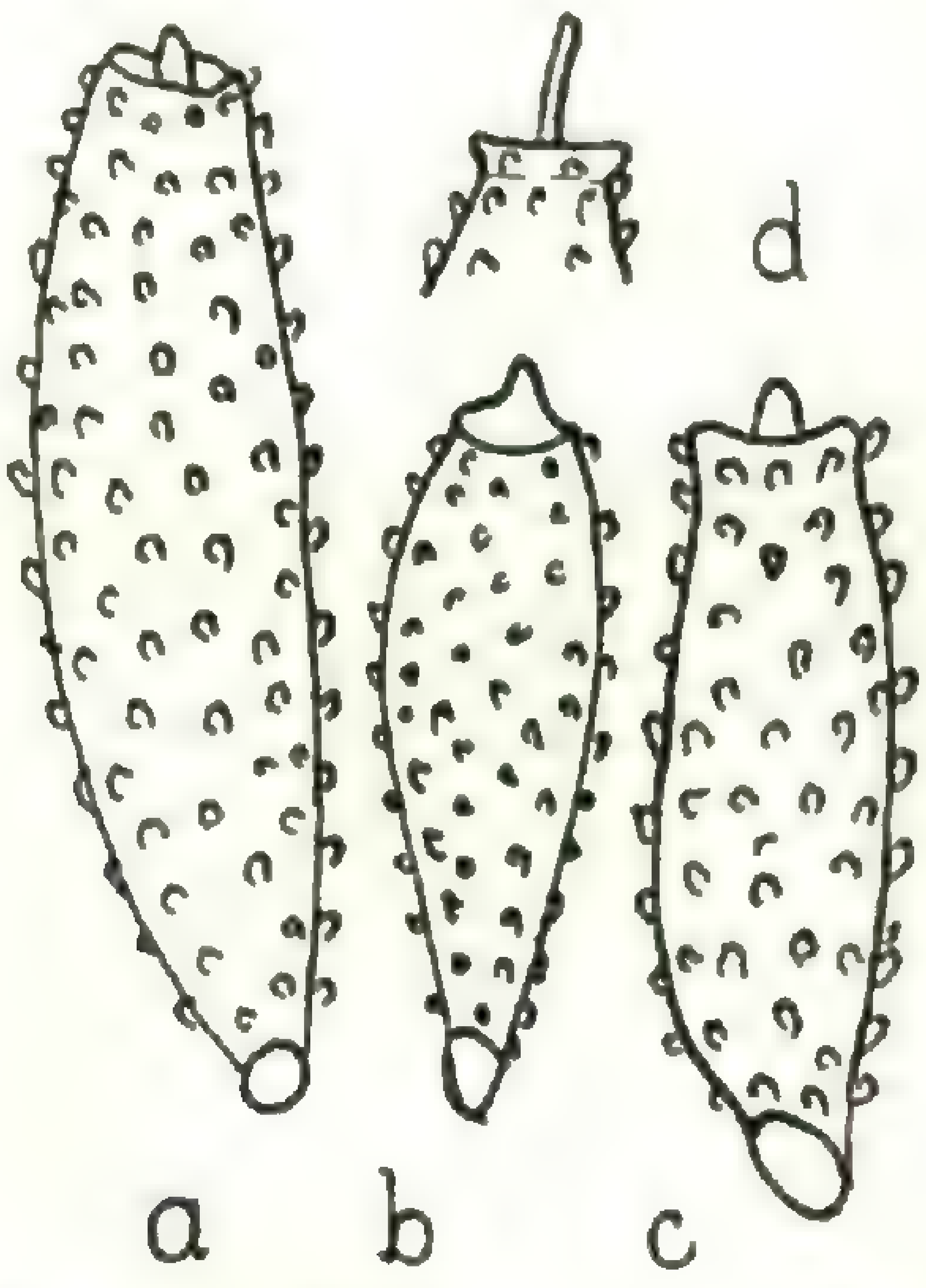

Fig. 1. Mature Achenes of *a:* Antennaria Parlinii; *b:* A. canadensis; *c:* A. petaloidea; *d:* A. spathulata; all × 16.

At full maturity the achenes of all the *Antennarias* investigated are very much alike as to form (Fig. 1.) They are terete, slightly tapering towards both ends so that the largest diameter is generally in the upper half. The pappus-bristles are united into a very short tube, breaking off as a whole and leaving an annular crown in the center of which the base of the style remains as a projecting short pointed tip. The outer wall of the achene is brownish with a faint fatty lustre. The cells of the epidermis are thick-walled, narrow, with square ends, forming regular longitudinal series. At the lower end of the achene is a globular nodule of thick-walled, uncolored cells, forming the part inserted in the pits of the receptacle.

[1] A. brevistyla Fern., published in this issue.—M. L. F.

When "papillae" are present, they are uniformly dispersed from the nodule to the pappus-crown. In the species there are small variations in the length and the density of the papillae from species to species, whereas they are remarkably uniform in the same head. Still I doubt that a species can be identified from these variations alone. On the dry and mature achene they appear as hyaline reflecting granules, easily seen by enlargements from 25 times upwards.

When the achenes are thrown into water they are only with difficulty wetted but will float for a long time. Still when they, after treating with a soft brush, are forced down, their specific gravity is shown to be greater than that of water. Having been soaked in water for 24–48 hours the "papillae" project well out from the surface as short gland-like hairs, bifurcated at the top. This result can be obtained more rapidly by placing the achenes in solutions of caustic soda or of chloral hydrate, or, better still, by placing the dry achenes directly in chloriodine of zinc. After a couple of hours they will have swelled,

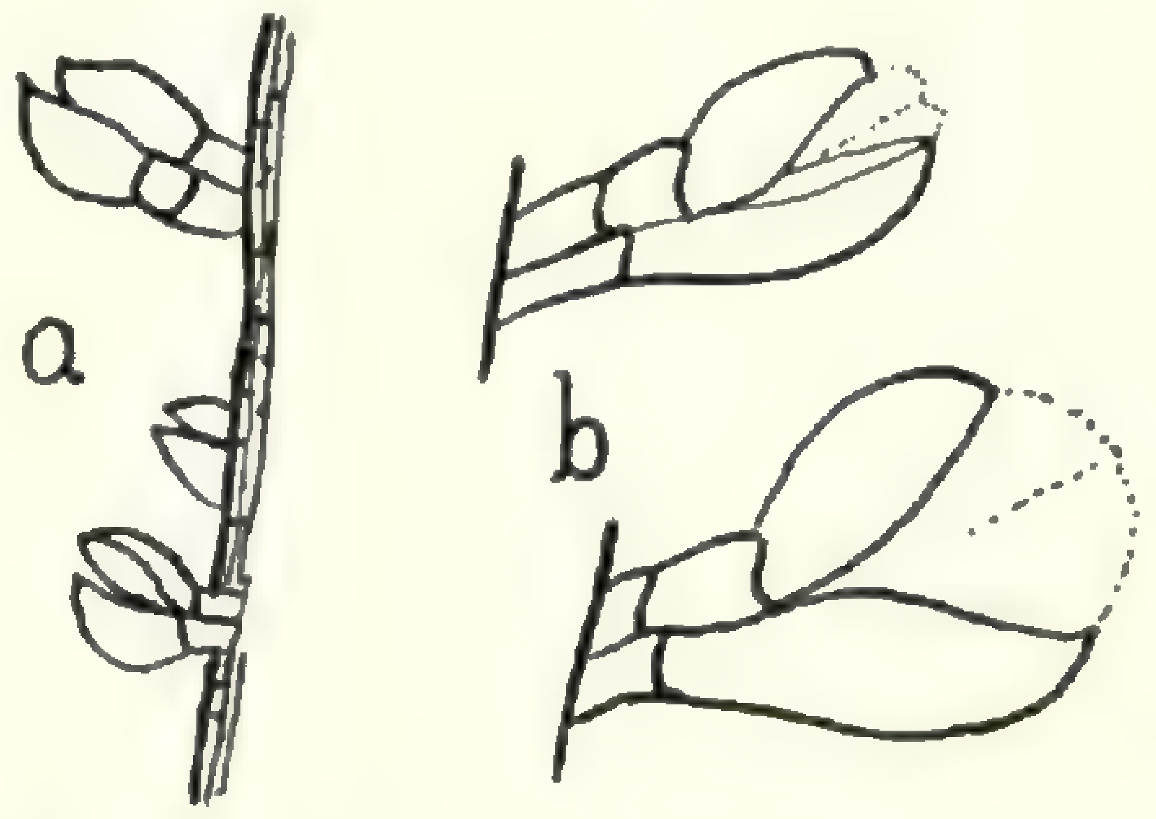

Fig. 2. Achenial Hairs swollen, *a:* of ANTENNARIA PETALOIDEA, × 133; *b:* A. NEODIOICA, × 265, showing drops of mucilage.

their upper halfs then being stained blue, the lower light yellow, contrasting well with the brown wall-cells. In strong solutions of chloral hydrate the terminal cells will finally distend to nearly a right angle. The forms of the hairs of the mature achenes will appear from FIGURES 2, a and b. They are essentially identical for all species investigated. They are always slightly directed upwards, and the lower terminal cell is always larger than the upper. In one instance I have seen a globular drop of mucilage in nearly all hairs on some half a dozen achenes contained on one slide, but unfortunately I have not been able to repeat the observation (FIG. 2, b). As plant mucilages generally have the same refraction exponent as water or watery solutions and as they are not colored with ordinary chemicals, they are always somewhat difficult to see. As, according to MOLISCH:

Mikrochemie der Pflanze. Jena 1913 p. 314, mucilage may be dissolved by chloral hydrate, this substance should be avoided where the occurrence of mucilage is studied.

These hairs evidently represent a form of the curious and very polymorphous *duplex hairs* or *twin hairs* occurring on the achenes of a great number of genera of the *Compositae*. In spite of the fact that these very peculiar organs with their still hardly understood functions (if any, some secreting mucilage, others containing elastic spires, elaters) seem to occur in all tribes of the *Compositae*, so as to be simply a main character for the whole family, they are generally not mentioned in the handbooks, either of taxonomy or of anatomy, not even in the elaborate treatment of the family by Hoffmann in Engler & Prantl, Pflanzenfamilien. An exception is Hegi's Illustrierte Flora von Mittel-Europa, VI.[1] p. 399, where a brief description, illustrated by some figures from a paper of Hanausek is given.

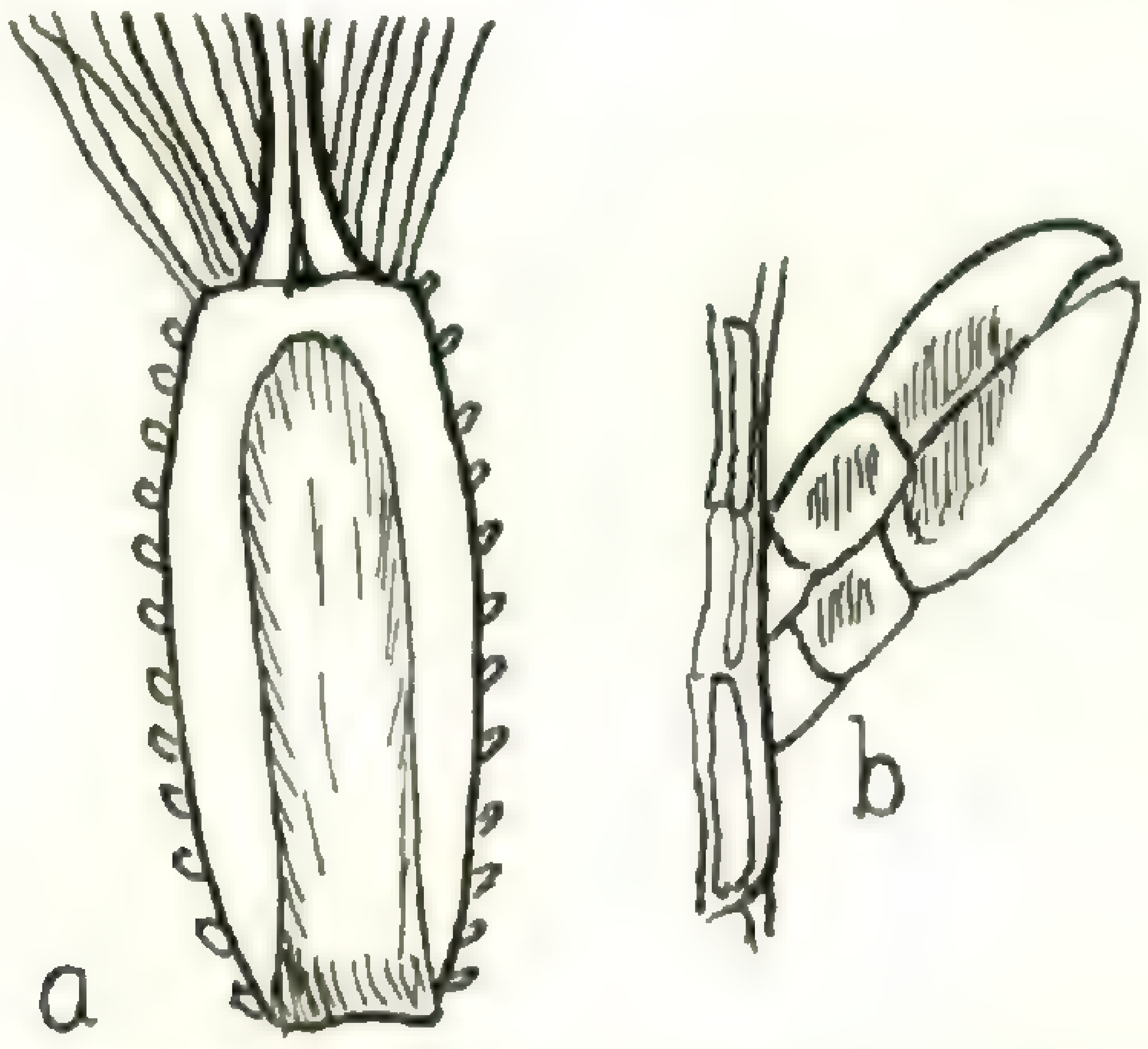

Fig. 3. *a:* Young Ovary of Antennaria neodioica, var. gaspensis, shown in optical section, × 16; *b:* achenial hairs, showing cell-contents, × 265.

In his most valuable and suggestive work "The Origin and Development of the Compositae" James Small gives[1] a brief but clear account of the principal types of twin-hairs and their occurrences in the generally adopted tribes of the *Compositae*. He also gives a bibliography reaching from 1861 to 1912, to which may be added: Hanausek: Zur Entwicklungsgeschichte d. Perikarps v. Helianthus annuus. Ber. D. Bot. Ges. 20. 1902. Professor Small and most of the previous writers quoted by him seem to ascribe to the twin-hairs great value as bearing on evolutional questions.

[1] J. Small, New Phyt. xvii. 72 et seq. 1918.

The hairs on the achenes of the *Antennarias* are nearly developed before the heads and the corollas expand. In lack of alcoholic material herbarium specimens will easily show them after a boiling in water, with a few drops of chloral hydrate added, and a subsequent transferring into alcohol for hardening. FIGURE 3, a, shows quite young and transparent achenes of *A. neodioica* var. *gaspensis* and FIG. 3, b, one of the hairs still with contents in the cells.

In dealing with the twin hairs of the *Compositae* HEGI says l. c. p. 399: "In vielen Fällen sondern die verdickten Haarzellen Schleim ab, welch' letzterer bei der Quellung im Wasser gleichsam ausgestossen wird. Auf diese Weise umgibt sich die Frucht mit einem klebrigen

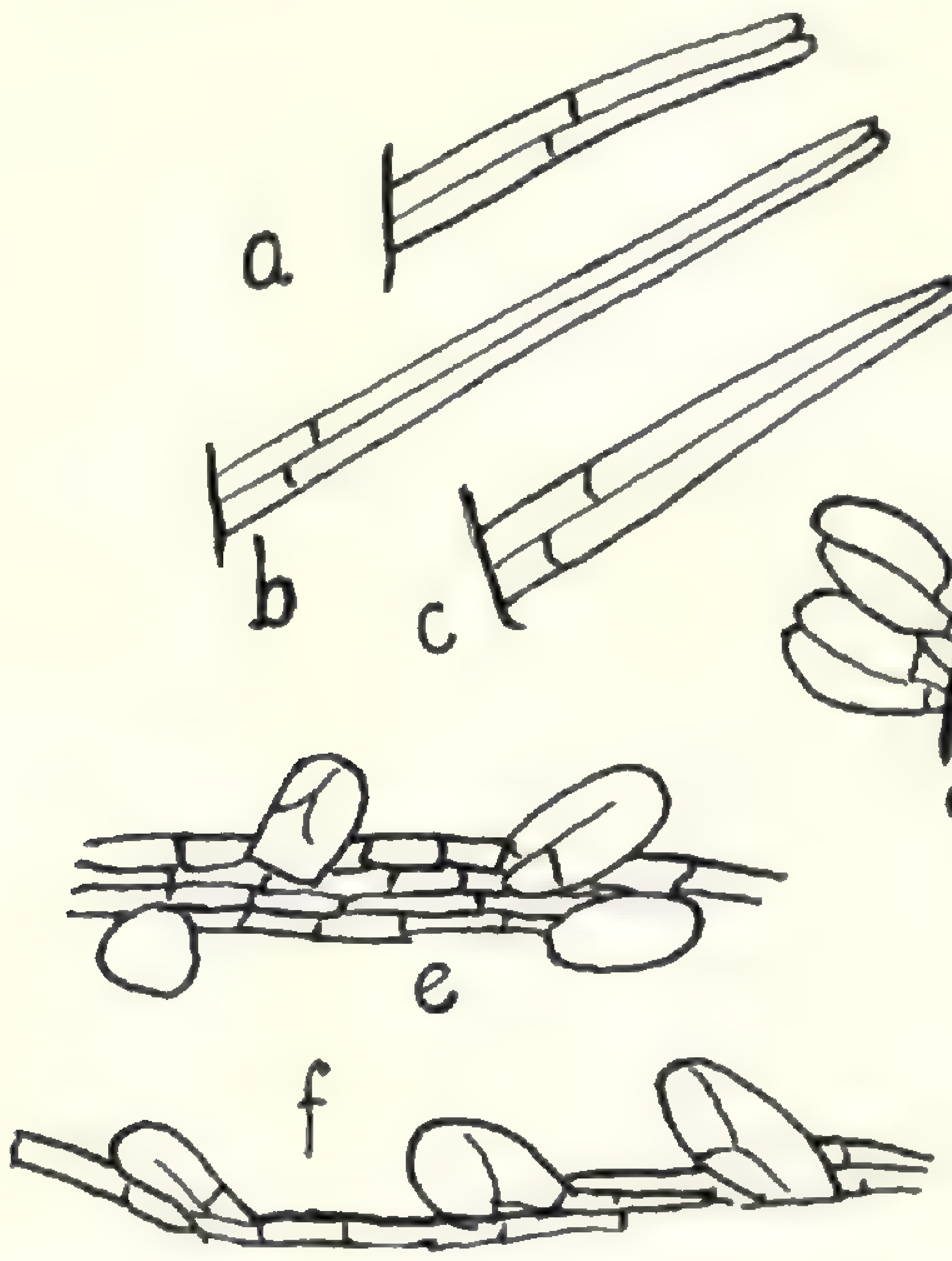

Fig. 4. Achenial Hairs swollen, *a:* of GNAPHALIUM NORVEGICUM; *b:* of G. SUPINUM; *c:* of LEONTOPODIUM ALPINUM; *d:* of FILAGO ARVENSIS; *e* and *f:* of ANTENNARIA PETALOIDEA, young staminate plant; all × 133.

Ueberzug, wodurch ein Festkleben der Achaenen an der Unterlage ermöglicht wird." From the quotation it cannot be seen whether this refers to an actual observed case or is merely a conjecture *per analogiam*. In our case such a function probably cannot be of much importance considering the minuteness of the mucilage drops in proportion to the size of the achene. A great number of species, probably the greatest part of the genus, have totally glabrous achenes and do quite as well. And I may here add that the abortive ovaries of the staminate plant of *A. petaloidea* also carry twin hairs, see FIG. 4, e and f. My

material was very young, taken before the corollas were expanded, so I cannot tell whether the hairs will develop to normal size and form. Here at least there cannot be such a function. Undoubtedly the hairs are an old character inherited from ancestral forms and in this connection it is interesting that fertile and apogamic species occur in both groups, those with hairs and those without.

James Small as well as the authors he refers to seems to be fairly convinced of the importance of the occurrence and the form-types of the achenial hairs in questions of interrelationship and evolution. Having, in Greenland, no access to the extensive literature on the subject, the present writer is unable to compare the conditions found in *Antennaria* with the cases known before. I could only look over the achenes of some genera and species which, according to the adopted taxonomy, are considered near relatives of *Antennaria*. And as my herbarium generally consists of specimens from Arctic or Alpine regions only, the suitable material was sometimes rather defective.

Gnaphalium.

The achenes of the boreal Old World species are partially described in the leading floras. Of these *G. arenarium* and *G. luteoalbum* would seem especially inviting for our purpose, but they are not at hand. The achenes are characterized thus:

	Hartman: Handb. Fl. Sk. 1879	Rouy: Fl. de France. Vol. 8	Hegi: Illust. Fl. Mitt.-Eur.
G. arenarium	glatta, grynprickiga	0	sehr feinknotig
G. luteoalbum	0	*glabres*, chagrinés	etwas rauh
G. uliginosum	sl¨ta, glatta	0	glatt
G. supinum	glest str¨fhåriga	pubescents	kurzhaarig
G. silvaticum	småhäriga	0	kurzhaarig
G. norvegicum	"	0	sp¨rlich behaart

The achenes of *G. uliginosum* are, as said, totally smooth and glabrous, differing widely from the three following ones. In the last three species they are conspicuously pubescent with straight, slightly ascending hairs. In the swollen state the upper parts of the hairs are glassy-hyaline, and by enlargements from 200 × upwards a longitudinal division is seen (see fig. 4, a and b). In *G. supinum* the pubescence is remarkably denser and the individual hairs longer, 0.13–0.15 mm., whereas in *G. silvaticum* and *G. norvegicum* they are 0.08–0.09 mm. only. The difference in the density suggested by Hegi I cannot see, nor is it noted in other Scandinavian floras. Also here the trans-

verse cells are not opposite, just as in *Antennaria.* Even after several days swelling no splitting of the terminal cells occur and no mucilage is seen. The hairs are thus evidently "duplex-hairs" but different in type from those of *Antennaria.*

The achenes of *Leontopodium alpinum,* by HEGI called "rauh," carry twin hairs of exactly the same type as *Gnaphalium,* 0.08–0.09 mm. long and perhaps slightly thicker (see FIG. 4, c). As in *G. supinum* the lower part is much shorter than the upper.

ANAPHALIS MARGARITACEA var. SUBALPINA. The young and quite immature achenes carry a *dense* covering of short, 0.05 mm. long, twin-hairs of the *Gnaphalium* or *Leontopodium* type.

The following species would, judging by the descriptions given, probably be inviting objects for comparison, but are unavailable here:

	HARTMAN	ROUY	HEGI
HELICHRYSUM ARENARIUM	0	chagrinés	sehr feinknotig
HELICHRYSUM ITALICUM	0	0	warzig rauh
FILAGO GERMANICA	hvitprickiga	finement glanduleux	0
FILAGO GALLICA	0	0	mit dicken glashellen Warzen besetzt

Instead I have studied mature achenes of *Filago arvensis,* of which nothing is said in the floras, but which in dry state would agree well with HEGI's description of *F. gallica:* covered with coarse, hyaline warts. Indeed they are a coarser representation of the "papillose" achenes in *Antennaria.* When swollen they appear like FIG. 4, d, often growing in clusters of twos or threes, which in drying shrink together to form the "wart." They project only 0.04–0.05 mm. from the epidermis.

Amongst the few species studied we thus found the achenial hairs most similar to those of *Antennaria* in a genus which in the adopted system is not considered the nearest relative of our genus.

At the end of this little investigation the author realizes too well its defectiveness. Yet, he hopes that the results obtained will suggest that the achenes of the great number of *Antennarias* already described and of those still to be proposed as new may be scrutinized for their achenial hairs and that investigations of the organs in related or ancestral genera may be taken up where ampler material and literature are at hand. The fact that glabrous and "papillary" species exist, both in great numbers, may perhaps suggest a polyphyletic origin

of the genus as we now understand it. The high number of chromosomes known for *A. dioica* and *A. alpina* also seem to speak for hybridogen origin.

Disko, Greenland.

THREE ANTENNARIAS FROM GREENLAND[1]

M. L. Fernald

Antennaria **affinis**, n. sp., humifusa, stolonibus foliosis (ad 4 cm. longis); foliis basilaribus spathulato-cuneatis apice subtruncatis vel late rotundatis vix mucronatis 6–13 mm. longis 2.5–6 mm. latis utrinque albidis pannoso-tomentosis; caule florifero 3–14 cm. alto; foliis caulinis 6–9 subdistantibus, imis anguste oblanceolatis obtusis, mediis linearibus acutis mucronatisque 8–13 mm. longis 2 mm. latis, superioribus 1–2 apice subscarioso subulato vel involuto 0.5–1 mm. longo munitis; capitulis femineis 1–15 dense corymbosis vel glomerulatis turbinato-campanulatis; involucro 5–5.5 mm. alto basi lanato subviscoso; bracteis 2–3-seriatis margine erosis, exterioribus late oblongis obtusis stramineis basi fulvescentibus, interioribus lanceolatis acutis apice ochroleucis; corolla 4–4.5 mm. longis, apice purpurea; stylo incluso vel vix exserto; achaeniis 0.8 mm. longis minute papillosis; foveis receptaculi ovoideo-conici maturi denudati 60–100 0.1 mm. latis quam jugis separantibus obtusis latioribus; planta mascula ignota.—Greenland: Ipiutarssuaq, 67° 42′, August 5, 1918, *M. P. & A. E. Porsild* (type in Gray Herb.); on basaltic moraines, S. Disco, Sinigfik, 69° 25′, August 12, 1929, *R. T. Porsild;* Kûk ("Kome"), 70° 36′, July 26, 1921, *A. E. Porsild;* sunny ledges, Agpat-formation, Umánaq Storø, Paornat, 70° 40′, July 8, 1929, *M. P. & R. T. Porsild;* Umánaq, August 25–30, 1923, *Elizabeth Ekman;* on sunny ledges of the Agpat-formation, Upernavikø, 71° 15′, July 14, 1929, *M. P. & R. T. Porsild;* Upernavik, 71° 20′, July 23, 1921, *A. E. Porsild;* all the Porsild collections distributed as *A. subviscosa* Fernald.

As stated, *Antennaria affinis* was distributed as *A. subviscosa* Fern., but it is not satisfactorily identified with the latter species which is known only from Bic, Rimouski County, Quebec, and from three stations in Gaspé County (Marsouin River, Cap Pleureuse and Gros Morne), where, with other relic species, it occupies shelves of vertical

[1] At the request of the late Professor Ostenfeld the description of the first species was sent to him for publication in Denmark. Owing to Dr. Ostenfeld's most regrettable and untimely last illness publication of the paper was overlooked. Dr. Porsild has most kindly supplemented the original material by beautiful specimens of additional numbers, as well as by two other species heretofore unknown in Greenland. One of the latter is here described; the other, too mature for exact identification, must await younger specimens.

calcareous sea-cliffs which remained nunataks during the Wisconsin glaciation. In *A. subviscosa* the cauline leaves are more generally acute, all but the basal ones acuminate or attenuate, the lower sharply mucronate, the 4–7 median and upper ones with slender subulate or involute, straight or unguiculate appendages 1.5–3 mm. long; the cauline leaves of *A. affinis* being blunt, or the upper merely acute, only the uppermost 1 or 2 with a short (0.5–1 mm. long) subulus. The basal leaves of *A. affinis* are broader and more rounded at tip than in *A. subviscosa* and with more pannose pubescence.

A. brevistyla, n. sp. humifusa, *A. vexilliferae* similis; foliis basilaribus anguste cuneato-obovatis 6–7 mm. longis apice rotundato 2.2–3 mm. latis vix vel brevissime mucronulatis albido-tomentulosis, tomentulo coactili; caule florifero 6–7 cm. alto; foliis caulinis 6–7 subdistantibus anguste lanceolatis vel lanceolato-linearibus 6–8 mm. longis 1.5–2 mm. latis, superioribus 4–5 apice scarioso late lanceolato plano 1.5–2 mm. longo munitis; capitulis femineis 4 glomerulato-corymbosis; involucro 5.5–6 mm. alto basi lanato; bracteis 20–30, 2–3-seriatis subaequantibus fulvescentibus, exterioribus oblongis obtusis vel subacutis, interioribus angustioribus acutis; corolla 4 mm. longa; stylo incluso vel breviter exserto subintegro; achaeniis glabris 1.3–1.5 mm. longis.—GREENLAND: on barren sandstone hills, S. Disco, Nûk øst for Marraq, 69° 25′, August 13, 1929, *R. T. Porsild* (TYPE in Gray Herb.).

Antennaria brevistyla strongly simulates *A. vexillifera* Fernald of the Shickshock Mountains of Gaspé and the limestone barrens of northwestern Newfoundland. All the collections of *A. vexillifera* (from four distinct areas) are consistent in having the styles long-exserted from the corollas and deeply 2-cleft. In the Greenland *A. brevistyla,* however, the styles are included or barely exserted and much less cleft. This character seems to be very consistent in other northern species: the included or but little exserted and only slightly cleft styles occurring in *A. intermedia* (Rosenv.) Porsild of Greenland, in *A. affinis* (described above), in *A. isolepis* Greene of the Labrador Peninsula, in *A. subviscosa* Fernald of the Gaspé region and in *A. umbrinella* Rydb. of the Rocky Mountains; but the greater number of boreal species have well-exserted and deeply cleft styles.

A. LABRADORICA Nutt. Trans. Am. Phil. Soc. n. s. vii. 406 (1841). *A. angustifolia* Elis. Ekman, Sv. Bot. Tidskr. xxi. 53, t. i. figs. 1, 2, 12 (1927), not Rydb. Bull. Torr. Bot. Cl. xxvi. 546 (1899). *A. Friesiana* Elis. Ekman, l. c. xxii. 416 (1928), at least as to the Greenland plant, perhaps not as to name-bringing synonym, *A. alpina,* var. *Friesiana* Trautv. Act. Hort. Petrop. vi. 24 (1879).

The identity of *Antennaria labradorica* Nutt. has long remained unsettled. In the summer of 1930, however, Dr. M. O. Malte and I found in the herbarium of the British Museum of Natural History three fragments from Nuttall, which, until a fuller specimen is located, must stand as the type of the species. The first fragment is a slender basal offshoot 1.7 cm. long, with linear-oblanceolate, acute (but not mucronate) densely canescent pilose-tomentose leaves 1–1.2 cm. long, 0.6–1.5 mm. broad. The other two fragments are two detached heads, lanate at base; the involucre 7 mm. high, with 2–3 series of subequal narrowly lanceolate to lance-linear long-attenuate fuscous to fulvous bracts (about 24 to a head), the inner bracts serrulate; corolla 3.6–4 mm. long, reddish-brown, with exserted style; achenes glabrous, 0.4 mm. long. This is the narrowest-leaved species of the "*alpina*" series, the plant described and beautifully illustrated by Mrs. Ekman as *A. angustifolia.* Whether *A. labradorica* includes *A. alpina,* var. *Friesiana,* as Mrs. Ekman believes, I am not yet able to determine. The geographic occurrence of the latter is rather against its being identical with a plant otherwise known only from northernmost Labrador and adjacent regions and from Greenland.

Gray Herbarium.

NOTES FROM THE HERBARIUM OF THE UNIVERSITY OF WISCONSIN—VII

Norman C. Fassett

For three years transplanted specimens of the plant described by the writer as *Dodecatheon Meadia* var. *amethystinum* have been closely observed in their development from early bud to mature fruit, and 15 individuals are now growing in his garden beside almost as many of the typical *D. Meadia.* The slender habit and brilliant flowers of the former plant give it an appearance so striking that additional characters have been sought on which to differentiate it from the common species of the Middle West. These have been found in the texture and proportions of the fruit, and the length of the floral parts, and appear to warrant the proposal of specific rank for the plant of the Mississippi River bluffs.

Dodecatheon amethystinum (Fassett) n. comb. *D. Meadia* var. *amethystinum* Fassett, Rhodora xxxi. 52 (1929). Plant slender, 2–3.5 dm. high; corolla-lobes constant in color, deep violet (rarely white

but without pale intermediates) becoming when pressed dark bluish-purple; flowers 2–11(–18) in an umbel; calyx-lobes not over ⅓ the length of the expanding corolla, 3–4.5 mm. long on the mature fruit; anthers 5–7.5 mm. long; capsule narrowly cylindric, 10–16 mm. long and 3–4.5 mm. thick, stramineous, with thin, almost papery walls, its valves 1.4–2 mm. long; seeds light castaneous or olive-brown.—Bluffs along the Mississippi River from Alma to the southern border of Wisconsin, and up some tributaries for about 12 miles. It has been collected at Winona, Minnesota, and will undoubtedly be found in northern Illinois and Iowa where they border the river in The Driftless Area.

D. Meadia L. Plant stout, 2.5–6 dm. high; corolla-lobes with every shade from white to pale lilac, rarely deep lilac; flowers usually 6–30 in an umbel; calyx-lobes at least ½ the length of the expanding corolla, 4–6.4 mm. long on the mature fruit; anthers 7–9 mm. long; capsule castaneous, ovoid-conical, 10–15 mm. long and 5–7.5 mm. thick, of firm subligneous texture, its valves 2–2.6 mm. long; seeds dark brown or nearly black.

Studies in the field and in the herbarium show that *D. amethystinum* flowers at least a week earlier than does *D. Meadia*. The type was collected by the writer at Prairie du Chien, Wisconsin, on June 2, 1928, and bore well-developed fruit, with only a few withered corollas persisting. The next day, *D. Meadia* was collected near Gays Mills, about 25 miles northeast of Prairie du Chien, but only about 10 miles east of the Mississippi River; it bore only 3 expanded flowers, and a large number of buds. A specimen of *D. Meadia* collected on May 30 of the same year, near Prairie du Sac, 100 miles east of the Mississippi, bore 2 very young fruits, 10 flowers, and at least 6 buds. In general it may be said that *D. Meadia* is coming into its prime on Memorial Day, while it is difficult to find *D. amethystinum* still in flower at that time.

D. Meadia is a plant of meadows, lightly wooded ground, and particularly of railroad rights-of-way. *D. amethystinum,* on the other hand, is almost entirely confined to mossy outcrops in cool damp woods on north-facing bluffs. Dr. C. H. Bunting, who first called my attention to this plant, has made the same observation in the vicinity of LaCrosse, as has also my student, Mr. Henry P. Hansen, of that city. The only collections made in open ground were by the writer, on May 2, 1931—nearly a month before *D. Meadia* came into flower. This was on the southwest-facing grassy or lightly wooded bluffs at Fountain City; at the same time this species was collected on the other side of the hills, in dense woods, where it had buds just expanding.

Plants collected at West Salem, Wisconsin, by Mr. N. W. Rowe, were at first considered as intermediate. West Salem is 13 miles east of the Mississippi River, in the valley of the LaCrosse River. Reexamination of Mr. Rowe's two specimens, both collected at the same time, shows one, in flower, to be fairly typical *D. Meadia*, while the other, in fruit, is *D. amethystinum*. Mr. Hansen, collecting at West Salem on June 7, 1930, found an abundance of *D. amethystinum* on shaded north-facing limestone cliffs, all in fruit. But the seeds are dark as in *D. Meadia*. A single plant has the robust habit and longer sepals of *D. Meadia*, but the capsule is rather slender, thin and light-colored. Since these are not so much intermediates as they are individuals combining the characters of the two species, they may be hybrids occurring where the ranges of the two overlap.

D. amethystinum is apparently a relic species in The Driftless Area, dating back to preglacial times. The whole problem of the preglacial relic flora in the Great Lakes states is a complex one, probably not to be completely solved on the basis of our present knowledge, but a few facts may be here reviewed. In the classic paper on this problem as it concerns the Gulf of St. Lawrence region, attention is called to certain plants of western America occurring locally in the vicinity of Lake Superior, on glaciated ground. It is suggested that these species survived the Wisconsin glaciation in The Driftless Area, later to migrate northward from a region "too hot and dry for the plants which occupy the headlands and peninsulas of Lake Superior."[1] But "hot and dry" is hardly an adequate expression of conditions in The Driftless Area. Many south-facing bluffs, it is true, answer this description, and support a prairie vegetation, clearly derived from the southwest; here we find, to name only a few species, *Petalostemum purpureum*, *P. candidum*, *Coreopsis palmata*, *Bouteloua hirsuta*, *B. curtipendula*, *Artemisia caudata*, *A. frigida*, and *Solidago rigida*. Dry sandstone bluffs and sand-plains, largely covered with blueberries, are frequent. But conditions in the mossy woods of the north-facing bluffs and deep ravines may be judged by the fact that throughout The Driftless Area *Asarum canadense* and *Arisaema triphyllum* are of frequent occurrence. It is hard to conceive of *Rubus parviflorus* (abundant in northern Wisconsin), *Arenaria macrophylla* (rare on cliffs in the Gogebic Range of Ashland and Iron Counties), *Epipactis decipiens* (in Wisconsin occasionally found in woods along Lake

[1] Fernald, Persistence of Plants in Unglaciated Areas of Boreal America. Mem. Am. Acad. of Arts & Sci. xv. 317 (1925).

Superior), *Osmorhiza divaricata* (in Wisconsin known only from Port Wing, but in Michigan abundant in the Porcupine Mountains and reported from Isle Royale), *Viola adunca* var. *glabra* (dry open places, Ashland, May 23, 1930, *N. T. Bobb* no. 98), and *Potamogeton filiformis* var. *Macounii* (collected by the writer in Vilas County, new to the Great Lakes region) as having migrated northward in a body, leaving no traces, from a region where, on some exposed bluffs and damp walls of canyons we know such Canadian and Hudsonian plants as *Arctostaphylos Uva-Ursi* var. *coactilis, Moneses uniflora, Equisetum scirpoides, Pyrus dumosa* (more frequent in southwestern Wisconsin than is *P. americana*), *Pinus Banksiana, Acer spicatum, Primula mistassinica*, and *Rhodendron lapponicum.*

The apparently preglacial flora of northern Wisconsin and neighboring territory has its affinities with the Rocky Mountains, with the Gaspé Peninsula, and with the Torngat Mountains. There is another relic flora in The Driftless Area, spreading sometimes as far east as the Indiana dunes, which has its affinities mostly with regions south of the area of Wisconsin glaciation. *Talinum rugospermum,* on sandstone bluffs and sand-plains, is closely related to and has been confused with *T. teretifolium,* which ranges from Pennsylvania through North Carolina to Alabama.[1] These species are apparently of common descent, isolated in the two regions by glaciation. *Spiraea tomentosa* var. *rosea*[2] has a range very similar to the combined ranges of the two species of *Talinum,* occurring from northwestern Wisconsin and southern Minnesota to the Indiana dunes, and in West Virginia and North Carolina.[3] *Sullivantia renifolia,*[4] extending only slightly beyond the limits of The Driftless Area, has a relative south of the glacial limits in Ohio and Indiana, and four related species occurring very locally in the Rocky Mountains. *Aconitum noveboracense,* found toward the southern limit of glaciation in New York and Ohio, is represented in southwestern Wisconsin and adjacent Iowa by the very rare and local var. *quasiciliatum.*[5] *Elatine triandra,* not in The Driftless Area, but definitely related to it,[6] is a species of local occurrence in the West, and doubtfully native in Maine. *Geum triflorum* has apparently spread in the Middle West, extending westward to North

[1] See Rhodora xxx. 205–206 (1928).
[2] Fernald, Rhodora xiv. 190 (1912).
[3] Peattie, Rhodora xxiv. 87 (1922), calls this an endemic derivative of the coastal plain flora in Indiana, but it seems to the writer better considered as a preglacial relic.
[4] Rosendahl, Univ. Minn. Stud. Biol. Sci. no. 6: 410 (1927).
[5] Fassett, Rhodora xxxi. 49 (1929).
[6] See Trans. Wis. Acad. of Sci., Arts & Lett. xxv. 199–200 (1930).

Dakota and eastward to New York; it is represented in western North America by a plant considered by the writer to be only varietally distinct,[1] but has no affinity with the Gulf of St. Lawrence region. *Montia Chamissoi*, of the Rocky Mountains, but with no stations in the East, is known from a single locality in The Driftless Area.[2]

This distinct relic flora, practically confined to The Driftless Area, with several endemics, having its affinities in unglaciated areas to the westward or to the southeastward, may be clearly interpreted on the basis of lack of glaciation in southwestern Wisconsin. But the occurrence in the Lake Superior region of plants of the Rocky Mountains and of the Gulf of St. Lawrence area is a problem that cannot at present be solved with any degree of certainty.

Madison, Wisconsin.

Two Abnormalities of Podophyllum peltatum.—Last spring, while out botanizing, one of the members of my class ran upon the

Fig. 1. Podophyllum peltatum, f. aphyllum.

interesting specimen, a photograph of which is here shown (fig. 1). Instead of the regular two leaves, out of the fork of which grows the

[1] See Rhodora xxx. 206–207 (1928).

[2] See Holzinger, The Plant World iv. 41–43 (1901).

flower, this flower rose right out of the ground, directly from the apex of the rhizome without a trace of a leaf, other than the scales at the base of the scape. The flower was not different from the usual flowers of *Podophyllum peltatum* L., many of which were growing along with the abnormality and with sterile shoots and formed a fairly large patch. Seeing a Podophyllum flower growing right up out of the ground was most remarkable.

The abnormality brought to mind one observed a number of years ago in the fruit, such as one might expect to run across, at least occasionally. Instead of one single fruit, there were clusters of fruits. In one specimen there were 7 variously sized fruits, and in the other 5, the entire cluster in each case weighing 3 or 4 times as much as the average single fruit.

Whether common or not, it would seem appropriate to call the first cited case f. *aphyllum*.[1] The second has already received a name, f. *polycarpum* Clute, Am. Bot. xxi. 93 (1915).—CHARLES C. PLITT, School of Pharmacy, University of Maryland, Baltimore, Maryland.

MOSS FLORA OF NORTH AMERICA.—The second part of Dr. Grout's new moss-flora[2] has appeared during the summer. It is gratifying to learn that subscriptions and other forms of encouragement seem to justify continued publication. Part 2 is of the same high grade as Part 1 (reviewed in RHODORA **31:** 38–39) and includes the genera *Leptodictyum, Amblystegium, Hygroamblystegium, Sciaromium, Cratoneuron, Campylium, Hygrohypnum, Scorpidium, Calliergon, Calliergidium, Calliergonella* and *Drepanocladus*. For the excellent illustrations the author has reproduced many figures from such well-known authorities as Bruch & Schimper, Limpricht, Sullivant, Dixon & Jamieson, Jennings, Husnot, and others. Apparently when suitable material for illustrative purposes from such sources was not available original drawings have been made. The grouping in some of the plates of the characteristics of nearly allied species or forms will undoubtedly facilitate ready comparison. We trust that future parts will now appear with reasonable regularity.—J. F. C.

[1] PODOPHYLLUM PELTATUM L., **f. aphyllum,** f. nov., caule sicut scapo foliis nullis. FIG. 1.

[2] A. J. GROUT, Ph.D. *Moss Flora of North America, North of Mexico*, Vol. III, Pt. 2, pp. 63–114, pls. XV–XXIX. June, 1931. Published by the author, 1 Vine St., New Brighton, Staten Island, New York City. Price $2.50.

The American Lotus at West Peabody, Massachusetts.—In Rhodora, April, 1916 (vol. 18), p. 90, the American Lotus (*Nelumbo lutea* (Willd.) Pers.), is recorded from West Peabody (George Larrivee, Aug. 14, 1913) and it is also stated that "a large colony of it is well established in a small pond near the railway in Lynnfield Center (J. Richard Lunt, Aug. 24, 1915)." Do these records by any chance refer to the same place?

This plant has been known to local flower-lovers and botanists for a long time to be well-established in the so-called Lily Pond or "Devil's Dish-bowl" just north of the railway in West Peabody. Recently (Aug. 20, 1931), I visited the place and secured specimens for our herbarium, and also talked with Mr. Daniel Brown of Peabody, who was instrumental in introducing it there. He told me that about 60 years ago, i.e., about 1870, a Mr. Silver of Salem, a sportsman interested in shooting, procured from South Carolina a lot of wild rice (*Zizania aquatica* L.) and that he (Brown) sowed a half bushel or more around the shores of the Lily Pond (which, by the way, is owned privately) in order to attract ducks. There were probably seeds of the lotus among the wild rice,—at all events, a year or two later it made its appearace in increasing amounts and has persisted till the present time. Now, a drive along the road at the north side of the pond in August reveals a very attractive floral display, the huge, upstanding lemon-colored blossoms and circular leaves imparting an almost tropical luxuriance to the spot. Albert P. Morse.

Peabody Museum of Salem.

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SOME NEW PLANTS FROM THE GASPÉ PENINSULA

M. L. Fernald and C. A. Weatherby

The completion a few years ago of the Perron Boulevard, the automobile road around the coast of the Gaspé Peninsula, has made available an area of great botanical interest which was formerly considered remote. In 1905 in one of his geological reports, Robert Chalmers wrote: "The roads are the worst in Eastern Canada, especially between Fox river and Sainte Anne des Monts"; consequently, until very recently this area has been difficult of access. In the same report Chalmers summarized his description of the region as follows:

"Most of the coast district between Fox river and Valley river [near Ste. Anne des Monts] is unsettled, except at the fishing stations . . . it forms an undulating plateau from 700–800 feet to 1,200–1,500 feet high,[1] trenched by rivers and brooks, and with a steep face to the gulf. The banks . . . are angular, abrupt, and without that rounded appearance so characteristic of ice-worn surfaces. . . . Inlets at the mouths of rivers and brooks are enclosed between steep, angular bluffs, the upper brow of these being sharp in outline and bearing no traces of ice-action. Nor do the higher hill sides and summits exhibit any erosion by ice, subaerial decay and waste having apparently had full sway here. These features char-

[1] Chalmers's accurate account has become much stretched in the account published by the Department of Highways and Mines (Provincial Tourist Bureau) where the tourist is told: "After leaving the shore line, the road begins to climb. It climbs, and climbs some more, until it reaches 2,000 feet above sea level, near Marsouis (or Marsouins), the next village of any importance. But even that dizzy height will seem as a 'slight declivity' by the time the traveller reaches the summit, or extreme altitude of the 'Boulevard,' at Ruisseau-Vallée, where the highway reaches 2,600 feet."—*The Gaspé Peninsula*, 101 (Quebec, Dept. Highw. and Mines, April, 1930).

acterize the coast district from Fox river, or Anse au Vallon, to Ste. Anne des Monts, this part of the coast being higher than that to the east or to the west."[1]

In discussing the floras of unglaciated areas of eastern Canada I wrote of this particular region: "Very similarly, many western or endemic species are confined to the cliffs and steep V-shaped valleys from Ste. Anne des Monts to Fox River, the region emphasized by Chalmers as practically unglaciated and where Coleman describes the valley of Rivière à la Martre which 'is cut 700 or 800 feet below the general level and is typically V-shaped. This and the striking re-entrants . . . show that it has never been shaped to any important degree by a valley glacier'; la Rivière aux Marsouins, with 'its valley . . . of the same type, deeply cut and V-shaped with bedrock showing at the bottom,' and beautiful Lac Pleureuse, whose 'steep shores present well-marked spurs which a glacier would have truncated.' This great stretch of essentially unglaciated and bleak coast is rugged, ragged and difficult to traverse. . . It is, consequently, almost unexplored, but such very slight examinations as have been made indicate that here is one of the chief regions of Gaspé for localized cordilleran types: *Woodsia scopulina* (Tourelle to Marsouin . . .), *Agrostis idahoensis* (Lac Pleureuse), *Carex misandroides* [rare Eastern representative of two local species of Alberta] (Lac Pleureuse . . .), *Salix laurentiana* [endemic ally of two Pacific Coast species] . . . , *Descurainia Hartwegiana* (Marten River . . .), *Astragalus aboriginum* [now found to be an endemic species of Mt. St. Pierre] . . . and *Oxytropis viscida* [also an endemic, *O. gaspensis*], (Mt. St. Pierre), *Hackelia deflexa*, var. *americana* (Mt. St. Pierre to Mont Louis . . .), *Artemisia frigida* (Cap Chat to Mont Louis) and *Arnica gaspensis* (Cap Tourelle)."[2]

In early July last, making a tour of the Perron Boulevard with members of our families, we spent one day, joined by Dr. G. Ledyard Stebbins, Jr., in a partial survey of Mt. St. Pierre, and other days, unfortunately without Stebbins's companionship, in very superficial collecting on the more available talus-slopes and cliffs from near Rivière à la Martre to Gros Morne. Our botanizing was necessarily very limited but younger and more agile botanists, especially with

[1] Chalmers, Geol. Surv. Can. Ann. Rep. n. s. xvi. 253a (1905).

[2] Fernald, *Persistence of Plants in Unglaciated Areas of Boreal America*, Mem. Gray Herb. ii. (Mem. Amer. Acad. xv.) 299, 300 (1925).

the skill of Stebbins in cliff-climbing, will find this region rich in novelties. Most of the easily available plants of interest, such as *Carex concinna* R. Br., *Androsace septentrionalis* L. and *Erigeron compositus* Pursh, var. *trifidus* (Hook.) Gray, were already known from the area; but we extended the known range of *Antennaria subviscosa* Fernald from Bic in Rimouski County to the high calcareous seawalls of Gaspé (Rivière aux Marsouins, Cap Pleureuse and Gros Morne), and that of *Arnica chionopappa* Fernald westward along the St. Lawrence to Gros Morne, and secured the usual quota of *Taraxacum* for further study from the cliffs and talus.

A few of the plants are of such unusual interest as to merit special discussion.

Carex (§ Montanae) **clivicola**, n. sp. Laxe cespitosa, *C. novae-angliae* simulans, omnibus partibus tamen major; vaginis basilaribus castaneis vel purpurascentibus, superioribus saepe puberulis vel hirtellis; foliis 2 mm. latis flaccidis saturate viridibus longioribus 2–3 dm. longis; culmis elongatis subcapillaribus curvantibus plerumque folia superantibus 2–3.5 dm. altis; spica mascula lineari-cylindrica attenuata sessili 5–10 mm. longa, squamis obtusis oblongo-ovatis stramineis vel brunneis albo-marginatis; spicis femineis 2 vel 3 subdistantibus omnibus sessilibus 4–7-floris ebracteatis vel ima bractea angustata foliacea 1–3.5 cm. longa aliquando subtensa; squamis ovatis obtusis mucronatisve 2.5–3 mm. longis 1.5–2 mm. latis stramineis brunneotinctis late albescenti-marginatis saepe erosis; perigyniis fusiformibus hirtellis 3.5–4 mm. longis 1–1.2 mm. latis basi lutescente spongiosa elongata, rostro brevi 0.4–0.8 mm. longo breviter bidentato paullo deflexo; achaenio trigono anguste obovoideo 2 mm. longo.—Quebec: dry thicket at head of calcareous slaty talus of inner slope, Mt. St. Pierre, Gaspé Co., July 5, 1931, *Fernald, Weatherby & Stebbins*, no. 2411.

Carex clivicola is nearest related to *C. novae-angliae* Schwein. and to *C. Rossii* Boott. In the shape of its perigynia it is very similar to the former but in *C. novae-angliae* the perigynia are only 2.5–3 mm. long and the pistillate scales are shorter, narrower and tapering to sharp tips. The foliage of *C. novae-angliae* is narrower than in *C. clivicola* and usually as long as or even longer than the culms; the lowest pistillate spike is usually definitely stalked, and the commonly stalked staminate spike has lanceolate or lance-ovate acuminate scales. From *C. Rossii* the newly proposed species at once differs in its laxer habit, its lack of short basal culms, smooth and flaccid leaves, blunt scales and slenderly fusiform, rather than strongly gibbous perigynia.

The type-station of *Carex clivicola* is a notable one, for the dry calcareous talus of the slope just below is characterized by a strange assemblage of species, many of them southern, many others rare or otherwise unknown or almost unknown south of the St. Lawrence. Here various species, such as *Acer pensylvanicum* L. and *Cornus rugosa* Lam., reach essentially their northeastern limits. The dominant color of the vegetation is supplied by the extensive thicket of particularly whitish "BOIS D'ARGENT," *Elaeagnus argentea* Pursh, while *Rosa blanda* Ait., often only 1 dm. high and with flowers scarcely 3.5 cm. broad, *Prunus depressa* Pursh, of New England river-gravels and seeming strangely out of place on dry subalpine rock-talus, and *Amelanchier gaspensis* (discussed in this paper), all abound. A whitish-leaved endemic representative of the cordilleran *Astragalus aboriginorum* Richardson (also discussed in this paper) here mingles with the endemic *Oxytropis gaspensis* Fern. & Kelsey, RHODORA, xxx. 123 (1928) and Fernald, l. c. 141, t. 171. With them or close by grow *Erigeron compositus*, var. *trifidus* (Hook.) Gray of arctic and northwestern America,[1] *Anemone multifida* Poir., of cordilleran (including Andean) range, the arctic and cordilleran *Draba stylaris* Gay, and other species making up a xerophytic association very unusual in eastern Canada. It is in the dry thicket at the top of this wind-swept talus that *Carex clivicola* forms a carpet. The habitat is much more like an arid ridge of the cordilleran region than the rich mesophytic forest of eastern Canada and northern and western New England in which *C. novae-angliae* abounds.

SAXIFRAGA CERNUA L., var. **latibracteata**, n. var., a forma typica recedit foliis caulinis superioribus reniformibus vel late ovatis basi cordatis vel subcordatis; bracteis dilatatis, inferioribus reniformibus vel suborbicularibus vel late ovatis plerumque lobatis, mediis ovatis vel ellipticis vel obovatis.—Baffin Island; Gaspé Peninsula, Quebec; Keewatin and Alberta. BAFFIN ISLAND: Cockburn Island, Pond's Inlet, August 20, 1904, *L. E. Borden*, Herb. Geol. Surv. Can. no. 62,973; Frobisher Bay, August, 1927, *C. S. Sewall*, no. 294. QUEBEC: calcareous sea-cliffs and rock-slides by the St. Lawrence, west of Rivière à la Martre, July 26, 1922, *Fernald & Pease*, no. 25,121, July 2, 1931, *Fernald & Weatherby*, no. 2449; mossy hornblende-schist at about 915 m., "Mt. Logan" (Mt. Mattaouisse), July 22, 1922, *Fernald & Pease*, no. 25,120; cold chimneys and rock-shelves at about 915–1000 m., south side of Fernald Pass, Mt. Mattaouisse, July 8, 1923, *Fernald, Griscom, Mackenzie, Pease & Smith*, no. 25,820; brook at head (about 1000 m. alt.) of Pease Basin, between Mts. Logan and Pembroke, July 13, 1924,

[1] See Fernald, RHODORA, xxx. 122 (1928).

Pease & Smith, no. 25,821; dripping cliffs and chimneys at head (about 1000 m. alt.) of Pease Basin, July 16, 1923, *Griscom & Pease*, no. 25,823; wet rocks and chimneys, alt. 825–1125 m., Gorge of Northeast Branch of River Ste. Anne des Monts, Tabletop Mts., August 5, 1923, *Fernald, Dodge & Smith*, no. 25,824 (TYPE in Gray Herb.). KEEWATIN: Fullerton, September 4, 1910, *J. M. Macoun*, Herb. Geol. Surv. Can. no. 79,247. ALBERTA: Rocky Mts., 1857–8, *Bourgeau;* Elbow River, June–July, 1897, *J. Macoun*, Herb. Geol. Surv. Can. no. 20,133; Malique Lake, July 19, 1908, *S. Brown*, no. 1270; Lake Louise, July 17, 1906, *S. Brown*, no. 663.

Typical *Saxifraga cernua* of Eurasia and of our arctic and high-alpine regions has the upper cauline leaves truncate to cuneate at base and all the bracts or all but the very lowest narrow (mostly linear-lanceolate to oblong-linear), the change from foliage-leaves to bracts being abrupt. This typical *S. cernua* extends south in America to the Torngat region of Labrador, very locally to the Shickshock Mts. of Gaspé (*Pease & Smith*, no. 25,822) and to the high mountains of Colorado and Utah.

It is probable that var. *latibracteata* includes some specimens referred to *S. cernua*, forma *bulbillosa* Engl. & Irmscher, Pflanzenr. iv[117]. 274, fig. 65, N (1916). Their figure 65, N might well have been drawn from the Fullerton material (*J. M. Macoun*, no. 79,247) which they cite as belonging to forma *bulbillosa*. Their description, however, makes no mention of divergence of the bracts from those of the common European and Arctic forms. In America var. *latibracteata* is so general a tendency of the species and such a departure from the forms (unless forma *bulbillosa* be excepted) recognized by Engler & Irmscher that it seems to us a definite geographic variety, comparable with frondose variations in other groups which occur about the Gulf of St. Lawrence.

AMELANCHIER **gaspensis** (Wiegand), n. comb. *A. sanguinea*, var. *gaspensis* Wiegand, RHODORA, xiv. 139 (1912).

In his revision of *The Genus Amelanchier in eastern North America*[1] Wiegand separated *A. sanguinea* (Pursh) DC. and *A. humilis* Wiegand from the cordilleran group represented by *A. florida* Lindl. by the fact that the two former have the "Margins of the leaf forming an angle at the apex," in *A. florida* and its allies the "Margins of the leaf forming a rounded or sub-truncate, rarely retuse, apex." The diagnostic characters of *A. sanguinea* used by Wiegand were: petals 11–20 mm. long; sepals 4 mm. long; hypanthium open and flat;

[1] Wiegand, RHODORA, xiv, 117–161 (1912).

racemes more or less drooping; upper veins of leaves running straight to the apex of the teeth, "not so in the var." *gaspensis*, which was separated by its essentially glabrous quality and by "the veins of the leaves prominently anastomosing before reaching the teeth." In his discussion Wiegand recognized that var. *gaspensis* is not very satisfactorily placed with *A. sanguinea* and that its relationship is as much with *A. humilis* and the group of *A. florida*, saying:

"The var. *gaspensis* is a perplexing form. It varies much in stature and in habitat, as well as in leaf-outline and dentation. The leaves suggest an intermediate condition between this species [*A. sanguinea*] and *A. humilis* especially in the venation. In its more glabrous nature it approaches *A. florida;* but the general appearance of the majority of the specimens, both when in flower and when in fruit, suggests that it is better to retain this form in *A. sanguinea* until further field study renders it better understood. More field work on all the Amelanchiers of Gaspé is very desirable."

Since the publication of *Amelanchier sanguinea*, var. *gaspensis* much material has accumulated. This forms a consistent series and maintains the venation and the glabrous characters first assigned to it. It departs from *A. sanguinea* in other characters: its leaves are usually so broadly rounded or subtruncate at summit that our own collection of the past summer went by Wiegand's key directly to *A. florida* and two of the collections made by Rousseau were distributed under the latter name; in well developed leaves there are only 6–13 pairs of primary veins, in *A. sanguinea* 10–16; its racemes are quite erect, or in shade merely ascending, but not drooping; the sepals are only 1.5–3.5 mm. long, in *A. sanguinea* 3.5–4.5 mm. long; and the very narrow (oblanceolate) petals are only 6–9 mm. long.

Differing from *A. sanguinea* in its glabrous or quickly glabrate foliage, its leaves commonly more rounded or subtruncate at summit, its fewer nerves with anastomosing tips, its erect racemes with glabrous or barely pilose rachis and pedicels, its shorter and glabrous or promptly glabrate sepals, and its shorter petals, and occupying a clearly circumscribed area northeast of the range of *A. sanguinea*, *A. gaspensis* seems to be quite as definite a species as any in the group.

The affinity of *A. gaspensis* with the *A. florida* complex of the cordilleran region and with the geographically intermediate *A. humilis* has been noted. From the former series it is at once distinguished by its thinner leaves with at most pale green lower surfaces, the cordilleran series having the coriaceous leaves glaucous beneath. From *A. humilis* it differs in its glabrous or promptly glabrate leaves

with more rounded or subtruncate summits and fewer veins, the glabrous or only sparsely pilose young rachis and pedicels (densely tomentose in *A. humilis*), the glabrous or promptly glabrate calyx and the narrower petals.

The following collections, all from the Gaspé Peninsula or neighboring counties of QUEBEC, belong to *A. gaspensis*. GASPÉ CO.: talus of calcareous cliffs near Cape Rosier, *Pease*, no. 20,216; prairies humides près de la Rivière York, *Victorin, Rolland, Brunel & Rousseau*, no. 17,431; marais saumâtres derrière le Barachois de Coin-du Banc, *Victorin et al.*, no. 17,434; ravin humid de la Grande-Coupe, Percé, *Victorin et al.*, no. 17,435; rocky bank, Percé Mt., Percé, August 16–20, 1904, *Collins, Fernald & Pease;* limestone detritus, Mt. Ste. Anne, Percé, July 24, 1905, *Williams, Collins & Fernald;* Grand River, June, 1903, *G. H. Richards;* dry slaty talus of cliffs, Lac Pleureuse, *Fernald, Dodge & Smith*, no. 25,840; Mont Louis, *Victorin*, no. 28,582; calcareous slaty talus toward summit of Mt. St. Pierre, *Fernald, Weatherby & Stebbins*, no. 2451; thickets near mouth of R. Ste. Anne des Monts, August 3–17, 1905, *Collins & Fernald;* slaty ledges by R. Ste. Anne des Monts, *Fernald, Griscom, Mackenzie & Smith*, no. 25,839. BONAVENTURE CO: alluvial woods, mouth of Bonaventure R., July 31, 1902, *Williams & Fernald*, (TYPE of *A. sanguinea*, var. *gaspensis*); gravelly beaches and flats, Bonaventure R., August 5–8, 1904, *Collins, Fernald & Pease;* rivage de la R. Matapedia, *Victorin*, no. 28,694. MATANE CO.: banks of Matane R., August 5, 1904, *F. F. Forbes;* calcaires gaspésiens, Ste.-Flavie, *Rousseau*, nos. 24,537; 24,554. RIMOUSKI CO.: dry ledges, Bic, July 15–18, 1904, *Collins & Fernald;* dry calcareous rocks and gravel, Bic, *Fernald & Pease*, no. 25,136; chemin de fer, Bic, *Rousseau*, nos. 26,241, 26,259; bois de conifères sur le conglomérat, Cap Enragé, Bic, *Rousseau*, no. 26,672.

RUBUS IDAEUS L., var. **eucyclus**, n. var., a var. *anomalo* differt turionibus cinereo-tomentulosis, pedicellis calicibusque valde glandulosis—QUEBEC: a small colony in the midst of an extensive area of var. *canadensis* Richardson, slightly west of Ruisseau à Rebour, Gaspé Co., July 3, 1931, *Fernald & Weatherby*, no. 2452 (TYPE in Gray Herb.).

Rubus idaeus, var. *eucyclus* is the third "reversionary" variation known in the species with simple or merely lobed and rounded leaves or with ternate leaves with rounded leaflets. In foliage it is quite like the much-discussed European var. *anomalus* Arrhenius (*R. obtusifolius* Willd., *R. Leersii* Bab.), but its tomentulose canes and glandular pedicels and sepals show that it is a mutation from the common var. *canadensis*, in the midst of which var. *eucyclus* was growing. The superficially very similar var. *Egglestonii* (Blanchard) Fernald, RHODORA, xxi. 97 (1919) (*R. idaeus*, var. *anomalus* Fernald, RHODORA, ii. 195, t. 20 (1900), not Arrhenius; *R. Egglestonii* Blanchard,

Torreya, vii. 140 (1907)) is a parallel "reversionary" variation from var. *strigosus* (Michx.) Maxim.

In var. *anomalus*, to quote Focke, "the restraining process, by which the form of the foliage leaves was so curiously modified, extended also to the carpellary leaves, and . . . the axes of these was [were] shortened, so that they did not close and completely envelop the ovules. Of the two ovules in each carpel, one uniformly pined away at a very early stage; the other developed itself during the blooming time in the normal way, but only few carpels were produced. In most cases, however, they dried up whilst the flowering was in progress; and, though some appeared to be fertilized, yet seed entirely failed to ripen. The infertility of the plant, I saw, was correlative to the character of its foliage; and we must look upon it as only a curious form of *R. idaeus*, which deviates from the type, so far as the form of the leaf is concerned, in the same manner that *Fragaria monophylla* deviates from typical *Fragaria vesca*."[1]

As I earlier pointed out, var. *anomalus* is not always sterile, for Babington[2] stated that it occasionally produces good seed, enough to have spread the plant to scattered stations. Whether var. *eucyclus* is sterile or fertile we cannot yet state. The colony, when discovered, was only in bud or very young anthesis.

ASTRAGALUS **scrupulicola**, n. sp. FIG. 1. Perennis; radice longissima verticali spongiosa caudicibus cespitosis; caulibus numerosissimis adscendentibus 1.5–3 dm. altis dense cinereo-tomentulosis; foliis 5–8 cm. longis; stipulis inferioribus late ovatis vel suborbicularibus obtusis basi connatis pallide brunneis chartaceis cinereo-tomentulosis 4–6 mm. longis, superioribus lanceolato-attenuatis dense adpresseque pilosis; foliolis 9–11 oblongo-lanceolatis obtusis sessilibus valde adscendentibus 1–2.5 cm. longis 3–7 mm. latis utrinque juventute saltem valde cinereo-tomentulosis jugis remotis; pedunculis axillaribus erectis cinereis 3–10 cm. longis; racemis laxe 7–17-floris anthesi 2–5 cm. maturitate 6–10 cm. longis; bracteis lanceolatis oblongisve brunneis scariosis cinereo-pilosis; pedicellis 1–2 mm. longis dense cinereis adscendentibus vel maturitate saepe arcuato-recurvantibus; calice dense adpresseque piloso pilis albescentibus, tubo 2.5–3 mm. longo, dentibus lanceolato-subulatis 1.5–2 mm. longis; corolla lactea 7–9 mm. longa, vexillo obovato retuso 1 cm. longo 6 mm. lato ungue lato 2.5 mm. longo; alis 7–9 mm. longis, ungue anguste lineari 3.5 mm. longo, limbo cuneato apice retuso 3 mm. lato, lobo basali unguiculato circa 1 mm. longo; carina obtusa lunata; leguminibus elliptico-lanceolatis falcatis compressis 2–3.2 cm. longis medio 4–6 mm. latis

[1] Focke, Journ. Bot. x. 27 (1872), translated from Oesterr. Bot. Zeitschr. (1870) 98.
[2] Babington, Journ., Bot. xvi. 85 (1878).

breviter pilosis apice acutis basi in stipitem gracilem 5–7 mm. longum calicem valde superantem attenuatis, suturis crassis non sulcatis; seminibus oblique reniformibus olivaceis paullo nitidis 2.2–3 mm. longis.—Gaspé County, QUEBEC: dry talus of slaty cliffs, northern face of Mt. St. Pierre, at mouth of Rivière à Pierre, August 14, 1923 (old fruit), *Fernald & Smith*, no. 25,872; talus slope near top of Mt. St. Pierre, July 29, 1927 (old fruit), *Kelsey & Jordan*, no. 73; "schistes" concassés, Mt. St. Pierre, 19 juillet, 1928 (old fruit), *Rousseau*, no. 31,182; slaty talus, Rivière à Pierre, July 20, 1928 (fruit), *Pease*, no. 20,144; calcareous "slate-pencil" talus, north slope of Mt. St. Pierre, July 4, 1931 (young fruit), *Fernald & Weatherby*, no. 2454 and in Pl. Exsicc. Gray.; calcareous slaty talus, southern slope of Mt. St. Pierre, July 5, 1931 (flowers and young fruit), *Fernald, Weatherby & Stebbins*, no. 2455 (TYPE in Gray Herb.).

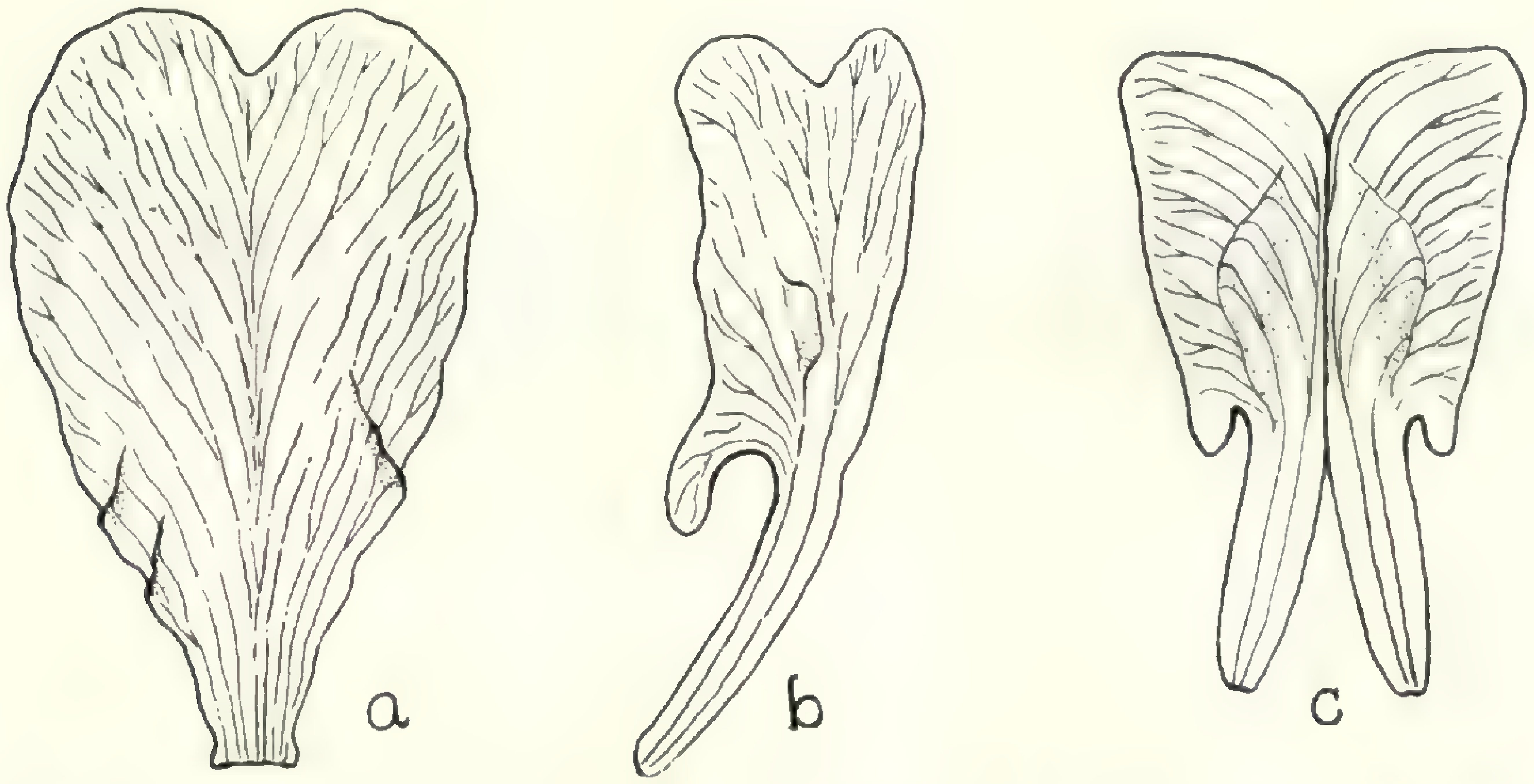

Fig. 1, ASTRAGALUS SCRUPULICOLA: *a*, vexillum; *b*, wing; *c*, keel, laid open; all × 5.

The earlier collections in over-ripe fruit were identified, on account of their cinereous pubescence and superficial characters, with the rare *Astragalus aboriginorum* Richardson in Frankl. Journ. App. 746—reprint, 18 (1823)—a species with an ungrammatical name which was soon altered to *A. aboriginum* Spreng. Syst. iv^2. 288 (1827). The name *A. aboriginorum* (or its grammatical substitute) has covered an aggregate of plants in western North America; but the original and very detailed description of Richardson (of a plant from Carleton House on the Saskatchewan) emphasizes the blackish-pilose calyx, the corolla whitish or bluish with the carina "eminente caerulea," and the wings with an obovate basal lobe. Rydberg, in monographing

the group, as *Atelophragma*, says: "the typical form, agreeing with Richardson's description and specimens, is apparently very rare. Representative specimens have been collected between Lake Winnipeg and Bear Lake, *Richardson;* Rocky Mountains and Saskatchewan, *Bourgeau*."[1] The Bourgeau material from the type locality (Carleton on the Saskatchewan), represented in the Gray Herbarium, has been approved by Rydberg with a mark of affirmation. In this the calyx is black-hairy and with calyx-lobes 2.5–3 mm. long; the wings have the broad basal lobe as described by Richardson and as illustrated by Hooker, as *Phaca aboriginorum* Hook. Fl. Bor.-Am. i. 143, t. lvi. (1830). In the Saskatchewan material (*Bourgeau*), as well as in specimens of Burke's from the east side of the Rocky Mts., sent by Hooker to Gray, the flowering raceme is rather dense, and this character is well displayed in Hooker's plate.

The plant of Mt. St. Pierre in Gaspé, of which we were fortunate enough to secure a belated flowering individual, shows in the flowers marked differences from authentic *Astragalus aboriginorum*. Its flowering raceme is very lax. The calyx is white- (not black-) pilose and with teeth much shorter than in the plant of the Saskatchewan. The corolla is milk-white throughout; the carina not "eminente caerulea." The basal lobe of the wings is narrower and unguiculate, with a rounded sinus; not obovate, with an acute sinus, as shown in Hooker's figure. The legumes, too, are narrower and more compressed.

We are unable to match *Astragalus scrupulicola* with any of the western species recognized by Rydberg in his revision of *Atelophragma* and, therefore, are proposing it as another endemic of the Gaspé Peninsula. The name refers to the habitat: the sharp and angular pencil-like talus into which the rock of Mt. St. Pierre and some of the adjacent headlands disintegrates.

In this talus *A. scrupulicola* is associated with the endemic *Oxytropis gaspensis* Fernald & Kelsey and *Carex clivicola* (described in this paper), with the Gaspé endemic, *Amelanchier gaspensis* (also discussed in this paper) and with other highly localized representatives of species of the Great Plains or the western Cordillera. We are indebted to Dr. H. M. Gilkey for the drawings of details of the corolla shown in FIG. 1.

Gray Herbarium.

[1] Rydb. Bull. Torr. Bot. Cl. lv. 120 (1928).

SALIX GLAUCA L. AND ITS ALLIES IN THE ATHABASCA-GREAT SLAVE LAKE REGION[1]

Hugh M. Raup

(Plate 218)

The writer has collected eighty-nine sheets of *Salix glauca* or its close relatives, in good fruiting condition, in the Athabasca-Great Slave Lake region during the past five summers. The greater part of these fall rather definitely into one group, and appear to be inseparable from the European specimens of *S. glauca* in the Gray Herbarium.

There have been varying opinions as to the presence of typical *Salix glauca* in America. Rydberg[2] regarded it as rare and "probably confined to the extreme northeast" (he also cites a specimen from Alaska). Coville[3] states that he was unable to separate Alaskan specimens from some of the European material. Schneider,[4] in monographing the group, reviewed the situation and said, "I agree with Coville that the North American forms are very similar to those of *S. glauca,* but they are in my opinion not fully identical with the typical *S. glauca* L. s. str."; and in another place, "In looking over the copious and well collected American specimens before me, I hesitate to designate them as typical *S. glauca,* nor am I willing to regard them as a separate species until a closer study of the circumpolar willow has convinced me of one fact or the other." He states that the American material seems to differ from the typical *S. glauca* "by the usually well developed stipules, by the longer pedicels of the fruits which normally are from one-half to twice longer than the gland, and by the tendency of the filaments to become almost glabrous."

The writer's material shows none of these differences. Stipules are present only in a few cases, though the specimens were collected both early and late in the season. The pedicels of the capsules are variable in length from a very nearly sessile condition to 1.5 mm., being sometimes twice as long as the gland, but more often shorter. These conditions vary greatly in the same ament. It is of note that the pedicels

[1] Published by permission of the Director of the National Museum of Canada, and during the writer's tenure of a National Research Fellowship in the Biological Sciences.

[2] Rydberg, P. A. Bull. N. Y. Bot. Gard. i. 271 (1899).

[3] Coville, F. V. Proc. Wash. Acad. Sci. iii. 321 (1901).

[4] Schneider, C. Bot. Gaz. lxvi. 326 (1918).

and glands of the European material in the Gray Herbarium show the same wide variation. In forming a description of typical *S. glauca*, following Linnaeus[1] and Enander,[2] Schneider makes the capsules sessile[3] but adds part of a description of Lapland material by Andersson,[4] who states that the capsules have very short pedicels. The evident variability of this character both in European and American material makes it of little value in an attempt to separate the two. The same is true of the amount of hair on the filaments, the material at hand matching most of the European in having a small amount at the bases of these. Floderus[5] states that the style in *S. glauca* is cleft to the base, and uses this character to separate it from other related species, but European specimens in the Gray Herbarium show styles quite variously cleft, as do also the American. There is a slight tendency toward greater division of the style in the European, but not enough to merit a separation. The leaves vary greatly on different plants and on the same plant, both as to shape and pubescence, but the same variations are to be found in the European specimens. Other characters used by Floderus, such as the color of the bracts and the lobing of the nectaries, also fail to merit a division.

The larger part of the writer's collection closely resembles many of the specimens labeled *S. glauca* var. *glabrescens* Schneider, but it seems unnecessary to give them varietal rank in view of the above. Another group of specimens appears to answer the description of *S. glauca* var. *acutifolia* of Schneider and to match specimens so labeled by him. This variety seems to be a consistent one, with smaller, more narrowly lanceolate or elliptic, thinly hairy leaves with slightly and irregularly denticulate margins. Schneider has assigned the Alaskan material to this variety. The remaining sheets show notable variations from the above. Several of them match precisely a specimen of *S. desertorum* Richardson in the Gray Herbarium. This specimen was collected by Richardson at Fort Franklin, and is evidently a part of the original material. Between these plants and *S. glauca* there is a series of intermediate transition forms, some of them appearing on the same plant (Plate 218). In Andersson's first treatment of *S. desertorum*[6] he considered it as a sub-species of *S. glauca*, stating that it

[1] Linnaeus, C. Fl. Lapp. 290 (1737).
[2] Enander, S. J. Stud. Salic. Linnés Herb. 51, 54, 59 (1917).
[3] Schneider, C. Ibid. 320.
[4] Andersson, N. J. Salic. Lap. 73, fig. 21 (1845).
[5] Floderus, B. in C. A. M. Lindman's *Svensk Fanerogamflora* 186–187. Stockholm (1918).
[6] Andersson, N. J. Öfv. K. Vet. Akad. Förh. 127 (1858).

was a well defined form and that transition forms between it and true *S. glauca* were occasionally seen. Later[1] he mentioned it as a species, but named as varieties of it certain forms which have been shown to be *S. brachycarpa* by Schneider.[2] When making it a sub-species of *S. glauca* Andersson also described it as an extreme arctic modification of this species.

In the semi-open prairies about 20 miles west of the upper Slave River, and again on the eastern slopes of the Caribou Mountains about 70 miles west of the prairies, were found shrubby willows with small, reticulate-veined leaves and short aments. These were found to match very closely specimens called *S. chlorolepis* Fernald var. *antimima* by Schneider,[3] and to resemble closely certain specimens from Fort Churchill, Hudson Bay, and from Mt. Albert, on the Gaspé Peninsula, labeled *S. brachycarpa* Nutt. by him. Study of authentic specimens of *S. chlorolepis* Fernald[4] and of *S. brachycarpa* Nutt.[5] indicate that the above material from Gaspé and Hudson Bay, as well as that collected by the writer, is much much more closely allied to the latter species. *S. chlorolepis* is well defined by its large, green bracts and by its entirely glabrous capsules, while the specimens in question differ from *S. brachycarpa* chiefly in their less pubescent leaves and twigs. *S. brachycarpa* is a hoary plant occurring in the Gaspé region and in the central Rocky Mountains, and is consistent through many collections. The less pubescent form has long been noted in the east as being quite distinct and also consistent. With the addition of the Churchill specimens and the writer's it appears to be a good geographic variety, forming a sub-arctic representative of the species, and the following new combination is therefore proposed:

Salix brachycarpa Nutt., var. **antimima** (Schneider), n. comb.
S. chlorolepis, var. *antimima* Schneider, Bot. Gaz. lxvi. 339 (1918).

Within the region from which the collections have been made, the above groups are rather clearly segregated. Typical *S. glauca,* of wide range in Europe and North America, is confined to rich woods or the muskeg borders of lakes and streams. Most of the specimens are from the gently rolling upland west of the upper Slave River.

[1] Andersson, N. J. DC. Prod. xvi². 281 (1868).
[2] Schneider, C. Ibid. 332.
[3] See Schneider, C. *Ibid.* 339.
[4] See Fernald, M. L. Rhodora vii: 185–186 (1905).
[5] See Nuttall, T. N. Am. Sylva i: 69 (1843).

Var. *acutifolia*, a well marked form with a wide-ranging consistency in Alaska and the northern Cordilleran region, is confined to the rocky uplands of the pre-Cambrian country east of the Slave River district. It has a range somewhat similar to that of another willow common in Alaska and entering the Great Slave Lake basin, *S. alaxensis*. Although the *acutifolia* group is confined to the semi-barren rocky country, typical *S. glauca* grows in the least exposed and richest woods at the eastern end of Great Slave Lake. *S. desertorum* was collected on the bleak, exposed, rocky shores on the north side of McLeod Bay, Great Slave Lake, while the forms approaching *S. brachycarpa* were seen only in the semi-open prairies and on the upper slopes of the Caribou Mountains west of the Slave River. *S. desertorum*, however, may prove to be nothing more than an occasional dwarfed form of the woodland *S. glauca*. Its rarity is attested by its sporadic occurrence in herbaria, although the regions in which it grows have yielded several other species of willows. It should also be noted that it has never been found in the extreme arctic regions, but only in districts near or in contact with wooded areas where *S. glauca* occurs.

The writer is indebted to Dr. M. O. Malte and to Professor M. L. Fernald for helpful suggestions.

Gray Herbarium,
Harvard University.

Hitchcock's "Field Work for the Local Botanist."[1]—Anyone with a sufficiently strong bent for local botanical investigation will achieve results of value, however isolated or otherwise at a disadvantage he may be—witness, for instance, Howell of Oregon, Frost of Vermont and Brendel of the "Flora Peoriana." The opportunity to make observations which will really add to the sum of knowledge is open to all who possess an active interest in field botany and fairly ready access to wild places. Many, however, miss it because of ignorance of methods or a fallacious impression that there is no longer anything to be found out except, perhaps, in the remote portions of the earth.

For such persons Dr. Hitchcock endeavors, in the pamphlet at hand, to provide encouragement, guidance and information. He has chapters, brief and simply put, on such subjects as woody plants in their winter condition, fruits and seeds and the dissemination of the latter, seedlings,

[1] Hitchcock, A. S. *Field Work for the Local Botanist.* Published by the author, 1867 Park Road, Washington, D. C. 58 pp. $1.10.

Photo H. M. Raup.

Figs. 1 and 2, Salix glauca; figs. 3–5, S. desertorum (Note intergradation of leaf- and ament-characters).

phenology, pollination, plant associations, floristics and the making of herbaria, each treated as possibly pointing the way to fruitful lines of investigation. For the beginner particularly, the little work should offer much helpful suggestion.—C. A. W.

Vol. 33, no. 395, including pages 213 to 230, was issued 14 November, 1931.

ERRATA

Page 8, line 16, *for* crowed, *read* crowded,
" 10, " 32, *for* unto, *read* into.
" 44, " 3 of foot-note, *for* Kungl, *read* Kungl.
" 49, " 31, *for* would had, *read* would have had.
" 67, " 21, *for* Ostendfeld, *read* Ostenfeld.
" 96, last line of caption, for *oxycoccus*, read *Oxycoccus*.
" 98, line 16, for *laracina*, read *laricina*.
" 101, " 22, for *callithrix*, read *callitrix*.
" 109, " 34, for *Thelypteris, Phegopteris*, read *Thelypteris Phegopteris*.
" 111, " 31, for *maritima*, read *patula*.
" 112, " 3, for *palustre*, read *palustris*.
" 159, " 6 for *floerkeana*, read *Floerkeana*.
" 165, " 27, *for* (Willd)., *read* (Willd.).
" 168, " 35, *for* analagous, *read* analogous.
" 179, " 43 *for* Toupinambaultiosl egit, *read* Toupinambaultios legit.
" 179, " 45, *for* SWEEDEN, *read* SWEDEN.
" 189, " 19, *for* Johnson, *read* Johnston.
" 207, " 22, for *geminata*, read *subgeminatus*.
" 214, " 6 and 33, *for* NEODOICA *read* NEODIOICA.
" 220, " 27, *for* sl¨ta, *read* släta.
" 220, " 28, *for* str¨fhåriga, *read* sträfhåriga.
" 220, " 30, *for* sp¨rlich, *read* spärlich.
" 227, " 12, for *Rhodendron*, read *Rhododendron*.

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